

AD-A246 392



NAVAL POSTGRADUATE SCHOOL
Monterey, California

2



THESIS

DTIC
ELECTE
FEB 21 1992
S B D

ECONOMIC ANALYSIS OF WATERFRONT
AREA SERVICES AT
NAVAL STATION, LONG BEACH

by

Shelly M. Hammon

June, 1991

Thesis Advisor:

Professor Dan C. Boger

Approved for public release; distribution is unlimited.

92-03910



Unclassified

SECURITY CLASSIFICATION OF THIS PAGE

| REPORT DOCUMENTATION PAGE | | | | Form Approved OMB No. 0704-0188 | |
|--|-------|--|---|--|--------------------------------------|
| 1a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED | | | 1b. RESTRICTIVE MARKINGS | | |
| 2a. SECURITY CLASSIFICATION AUTHORITY | | | 3. DISTRIBUTION/AVAILABILITY OF REPORT Approved for public release; Distribution is unlimited | | |
| 2b. DECLASSIFICATION/DOWNGRADING SCHEDULE | | | | | |
| 4. PERFORMING ORGANIZATION REPORT NUMBER(S) | | | 5. MONITORING ORGANIZATION REPORT NUMBER(S) | | |
| 6a. NAME OF PERFORMING ORGANIZATION Naval Postgraduate School | | 6b. OFFICE SYMBOL (If applicable) Code 36 | 7a. NAME OF MONITORING ORGANIZATION Naval Postgraduate School | | |
| 6c. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000 | | | 7b. ADDRESS (City, State, and ZIP Code) Monterey, California 93943-5000 | | |
| 8a. NAME OF FUNDING / SPONSORING ORGANIZATION | | 8b. OFFICE SYMBOL (If applicable) | 9. PROCUREMENT INSTRUMENT IDENTIFICATION NUMBER | | |
| 8c. ADDRESS (City, State, and ZIP Code) | | | 10. SOURCE OF FUNDING NUMBERS | | |
| | | | PROGRAM ELEMENT NO | PROJECT NO. | TASK NO |
| | | | | | WORK UNIT ACCESSION NO. |
| 11. TITLE (Include Security Classification) ECONOMIC ANALYSIS OF WATERFRONT AREA SERVICES AT NAVAL STATION LONG BEACH, UNCLASSIFIED | | | | | |
| 12. PERSONAL AUTHOR(S) Hammon, Shelly M. | | | | | |
| 13a. TYPE OF REPORT Master 's Thesis | | 13b. TIME COVERED FROM _____ TO _____ | | 14. DATE OF REPORT (Year, Month, Day) 1991, June | |
| 15. PAGE COUNT 86 | | | | | |
| 16. SUPPLEMENTARY NOTATION The views expressed in this thesis are those of the author and do not reflect the official policy or position of the Department of Defense or the U.S. Government | | | | | |
| 17. COSATI CODES | | | 18. SUBJECT TERMS (Continue on reverse if necessary and identify by block number) | | |
| FIELD | GROUP | SUB-GROUP | Cost-Benefit Analysis | | |
| | | | | | |
| | | | | | |
| 19. ABSTRACT (Continue on reverse if necessary and identify by block number) This study is an economic analysis of the Waterfront Area Services operation at Naval Station Long Beach. The objective of this research was to determine the best strategy to improve operational efficiency with respect to both quality of service provided and dollar/asset utilization. Specific issues addressed are the establishment of a Naval Station Long Beach operated Waterfront Area Shop, allocation of crane service resources, and the improvement of communication between Naval Station Long Beach, Long Beach Naval Shipyard, and Fleet ships. Data was gathered through personal interviews with Naval Station and Shipyard personnel from the various operational and support offices involved with waterfront operations. | | | | | |
| 20. DISTRIBUTION/AVAILABILITY OF ABSTRACT <input checked="" type="checkbox"/> UNCLASSIFIED/UNLIMITED <input type="checkbox"/> SAME AS RPT <input type="checkbox"/> DTIC USERS | | | 21. ABSTRACT SECURITY CLASSIFICATION Unclassified | | |
| 22a. NAME OF RESPONSIBLE INDIVIDUAL Professor Dan C. Boger | | | 22b. TELEPHONE (Include Area Code) (408) 646-2607 | | 22c. OFFICE SYMBOL Code 36 |

DD Form 1473, JUN 86

Previous editions are obsolete.

SECURITY CLASSIFICATION OF THIS PAGE

S/N 0102-LF-014-6603

Unclassified

Approved for public release; distribution is unlimited.

**Economic Analysis of Waterfront
Area Services at
Naval Station, Long Beach**

by

**Shelly M. Hammon
Lieutenant, United States Navy
B.S., University of Pennsylvania, 1984**

**Submitted in partial fulfillment
of the requirements for the degree of**

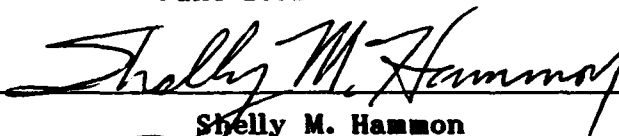
MASTER OF SCIENCE IN MANAGEMENT

from the

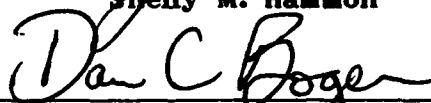
NAVAL POSTGRADUATE SCHOOL

June 1991

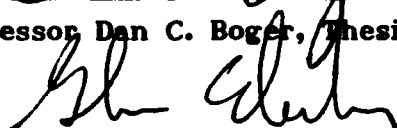
Author:


Shelly M. Hammon

Approved by:



Professor Dan C. Boger, Thesis Advisor



Commander Glen Eberling, Second Reader



Professor David R. Whipple, Chairman
Department of Administrative Science

ABSTRACT

This study is an economic analysis of the Waterfront Area Services operation at Naval Station Long Beach. The objective of this research was to determine the best strategy to improve operational efficiency with respect to both quality of service provided and dollar/asset utilization. Specific issues addressed are the establishment of a Naval Station Long Beach operated Waterfront Area Shop, allocation of crane service resources, and the improvement of communication between Naval Station Long Beach, Long Beach Naval Shipyard, and Fleet ships. Data was gathered through personal interviews with Naval Station and Shipyard personnel from the various operational and support offices involved with waterfront operations.

| | |
|--------------------|--|
| Accession For | |
| NTIS GRA&I | <input checked="checked" type="checkbox"/> |
| DTIC TAB | <input type="checkbox"/> |
| Unannounced | <input type="checkbox"/> |
| Justification | |
| By | |
| Distribution | |
| Availability Codes | |
| Dist | Avail and/or Special |
| A-1 | |

TABLE OF CONTENTS

| | | |
|------|---|----|
| I. | INTRODUCTION | 1 |
| A. | PROBLEM STATEMENT | 2 |
| 1. | Lack of Direct Control Over Waterfront Assets | 2 |
| 2. | Fluctuations in the Quality of Service ... | 2 |
| B. | OBJECTIVE | 3 |
| C. | SCOPE | 3 |
| II. | BACKGROUND | 4 |
| III. | CURRENT OPERATIONS | 11 |
| IV. | METHODOLOGY | 17 |
| V. | ANALYSIS | 20 |
| A. | COMMUNICATION ISSUES | 20 |
| 1. | Welcome Aboard Program | 21 |
| 2. | Formal Liaison Billet | 23 |
| 3. | Communication at the Job Site | 24 |
| B. | REQUIREMENTS TO ESTABLISH A NAVAL STATION- OPERATED WATERFRONT AREA SHOP | 25 |
| 1. | Mission Description | 26 |
| 2. | Hours of Operation | 28 |
| 3. | Equipment Asset Requirements | 31 |
| 4. | Manpower Asset Requirements | 36 |
| 5. | Support Services | 38 |

| | | |
|---------------------------|--|----|
| 6. | Damaged, Lost, and Obsolete Equipment | 39 |
| 7. | Billet Descriptions and Responsibilities ... | 40 |
| 8. | Safety Concerns | 40 |
| 9. | Excess Demand | 41 |
| C. | DISCUSSION OF WATERFRONT AREA SHOP PROPOSAL .. | 41 |
| D. | VIALE ALTERNATIVES | 43 |
| VI. | ECONOMIC ANALYSIS OF THE GRADALL MATERIAL HANDLING UNIT | 45 |
| A. | FEATURES | 45 |
| B. | POTENTIAL UTILIZATION | 48 |
| C. | ADVANTAGES OF THE EQUIPMENT | 48 |
| D. | BENEFIT-COST ANALYSIS | 50 |
| E. | OVERVIEW | 58 |
| VII. | RECOMMENDATIONS FOR ACTION | 59 |
| VIII. | CONCLUDING REMARKS | 62 |
| APPENDIX A: | SHIP MOVEMENT SCHEDULE | 64 |
| APPENDIX B: | HOURS OF CRANE SERVICE FOR OCTOBER 1990.... | 67 |
| APPENDIX C: | LIST OF ASSET REQUIREMENTS FOR A WFAS | 69 |
| APPENDIX D: | GRADALL 534B MATERIAL HANDLING UNIT LIST OF STANDARD FEATURES AND ATTACHMENTS . | 72 |
| LIST OF REFERENCES | | 76 |
| BIBLIOGRAPHY | | 78 |
| INITIAL DISTRIBUTION LIST | | 79 |

I. INTRODUCTION

The Department of Defense, like many public agencies, is suffering from the effects of reduced funding. Limited resources are prompting the need for improved efficiency. To ensure adequate future support can be provided to its customers, Naval Station Long Beach (Navsta) is striving to make its waterfront service operations more efficient. Waterfront services encompass: (1) placement and removal of brows; (2) provision of hotel services; (3) onloading of stores and equipment; and (4) removal of equipment for turn-in or disposal. The assets required to perform these services are primarily owned and operated under the auspices of the Long Beach Naval Shipyard. Navsta and Shipyard mission statements occasionally produce conflicting priorities, creating friction between the two entities.

At the request of Naval Station Long Beach, this study was conducted to evaluate communications between Navsta, Long Beach Naval Shipyard, and Fleet ships; identify requirements needed to establish a Navsta-operated Waterfront Area Shop (WFAS); research the current allocation of crane service assets; and develop alternatives to best improve efficiency of waterfront operations.

A. PROBLEM STATEMENT

Navsta has identified the following two primary deficiencies under the current system: (1) Navsta's lack of direct control over waterfront area assets; and (2) fluctuations in the quality of service.

1. Lack of Direct Control

Navsta is dependent upon the Shipyard to perform its responsibilities. Although it is Navsta's responsibility to provide high quality waterfront services, the manpower and material resources that comprise waterfront area services are under the direct control of Shipyard production shops.

2. Fluctuations in Quality of Service

Quality fluctuations occur when both organizations require the same resources concurrently. The Shipyard frequently assumes a higher priority and diverts its resources to shipyard work. When this occurs, Navsta is forced to either cancel or delay services to its customers. These occasional shifts of resources, especially when short-fused, allow little time for making alternative arrangements to satisfy Navsta's responsibilities to its customers.

B. OBJECTIVE

The purpose of this study is to: evaluate the current waterfront services operation with respect to both quality of service and dollar/asset requirements; identify specific requirements needed to establish an independent Waterfront Services Area Shop (WFAS); and to determine whether the establishment of a Navsta operated WFAS is a viable solution to alleviate the problems identified in the Problem Statement. Based on the analysis conducted, this study will recommend the best strategy for the Navsta to pursue.

C. SCOPE

The general scope of this assessment will include asset requirements and issues concerning the establishment of an independent, Navsta-operated Waterfront Area Shop (WFAS). Results and alternatives will be evaluated and discussed.

During the research phase, it was evident that most of the friction between Navsta and the Shipyard centered on the control and allocation of crane service resources. Therefore, added attention was directed toward developing alternatives dealing specifically with this aspect of waterfront service.

II. BACKGROUND

Naval Station Long Beach was downgraded to a Naval Support Activity in 1974, in response to military force reductions following the Vietnam conflict. The base was then reinstated to Naval Station status in 1979. However, during the five year period that Navsta was in a reduced status, the assets and authority required to provide waterfront services were transferred to the Long Beach Naval Shipyard.

With the reinstatement of Naval Station status, Navsta resumed the responsibilities for providing waterfront area services to the Fleet. However, assets previously transferred to the Shipyard remained in the the Shipyard's custody. Navy directives prohibited Navsta from procuring duplicate assets to the Shipyard. Thus, they were required to contract with the Shipyard, through a series of Intraservice Agreements (ISA's), for the waterfront area services needed to support the fleet homeported at Long Beach.

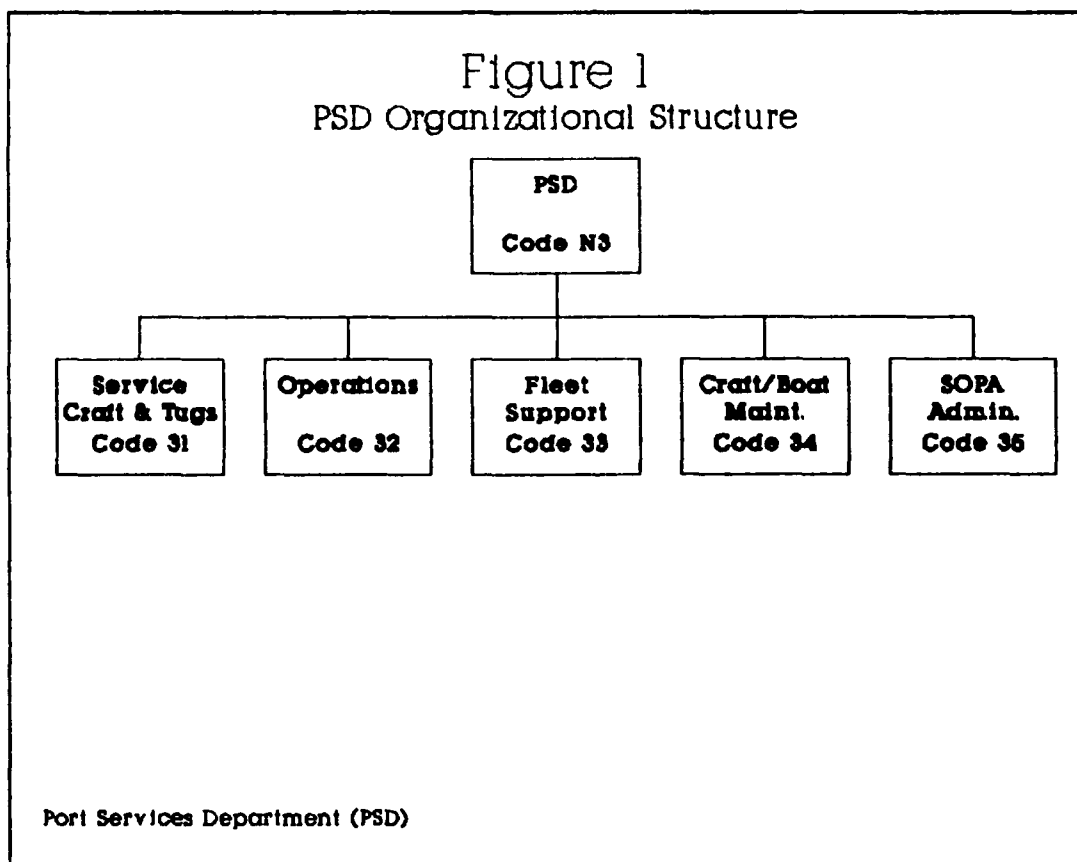
Waterfront operations at the Navsta are the responsibility of the Port Services Department (Code N3). Its mission is to provide on a 24 hour basis:

- 1) Waterfront services to the fleet - berthing, equipage offloads, stores onload, fuel, and ordnance.

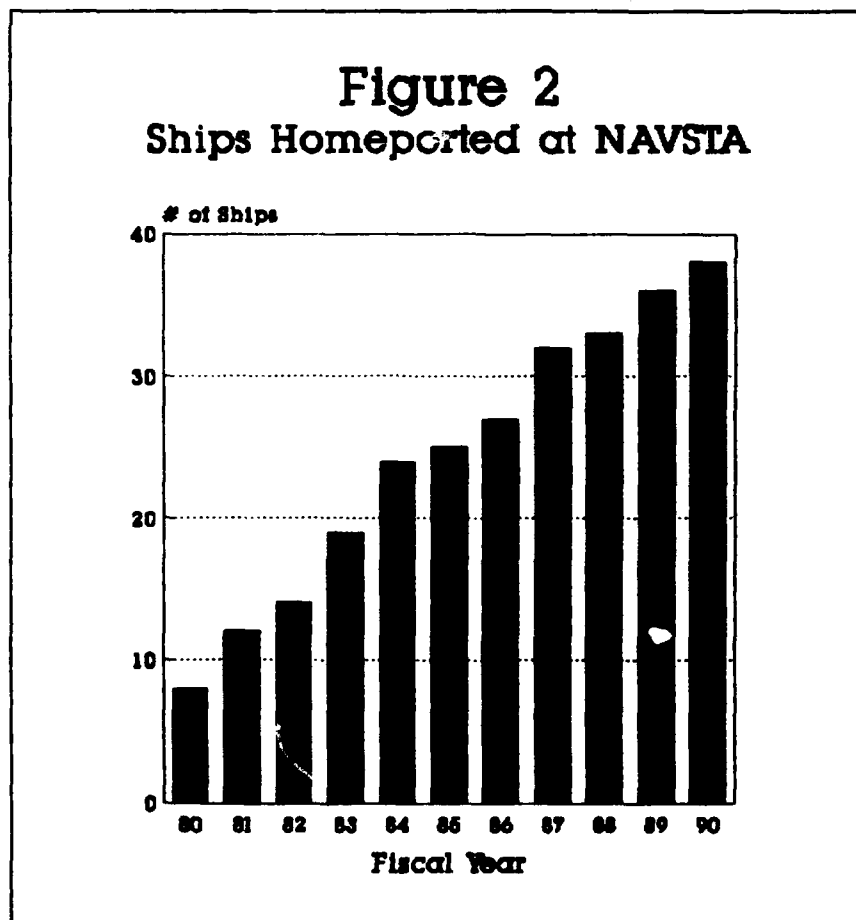
2) Coordinate fleet support matters with SOPA, Defense Fueling Region West, Naval Weapons Station Seal Beach, and Long Beach Naval Shipyard.

3) Provide for the operation, administration, security, and maintenance of service craft, boats, and shops.

Port Services is divided into five major divisions as shown in Figure 1.



Currently Navsta provides waterfront services to thirty-eight ships homeported at Long Beach. Various ship classes are represented, including amphibious, auxiliary, combatant, and logistics ships. However, due to environmental restrictions, all ships homeported at Long Beach are non-nuclear. Since 1979, the number of ships homeported at Navsta has more than quadrupled. This increase has been relatively steady from year to year and is shown by Figure 2 [Ref. 1].



This expansion may contribute to the conflict between Navsta and the Shipyard concerning control over the assets required for an efficient waterfront operation. It is by no means the central focus behind the friction, but increasing demand for relatively fixed crane resources as well as other resources can negatively impact on their availability to Navsta.

In 1988 Navsta established a "dedicated" maintenance shop under the direction of the Public Works Department (PWD). This shop was named the Public Works Area Shop (PWAS), and its primary function was to provide general maintenance services for the Navsta and the housing area. It was originally a Shipyard-operated shop that was transferred to the control of the PWD to function as a dedicated shop for Navsta initiatives. It was a relatively simple reorganization since the personnel and equipment transferred to the PWAS came from only one shop within the Shipyard. It is important to note that with this transfer came a change in policy regarding the laborhour rate charged. The new laborhour rate adopted was the current PWD rate rather than the Shipyard rate. The PWD rate was less than the rate charged by the Shipyard, even though it was essentially for the same personnel and services previously provided. The PWAS has functioned superbly since the reorganization and has saved the Navsta both substantial amounts of money in repair costs, and most notably, in service response time. [Ref. 2]

An attempt was made in 1989 to establish a Navsta-operated waterfront area shop (WFAS) independent of the Shipyard. This proposal was prompted by Navsta's desire for greater autonomy in providing improved fleet support. The WFAS was formed by transferring predetermined manpower and equipment assets from the Shipyard to the Public Works Department. This transfer placed waterfront service assets under the direct control and supervision of the Navsta. It was assumed that such a transfer would provide Navsta with "dedicated" resources specifically designed to meet their requirements and priorities without restrictions or interference from the Shipyard.

The WFAS was initially designed to fall under the direction of the PWD, similar in organizational structure to the PWAS. However, in contrast, the newly established WFAS was considered a failure and was disestablished in a relatively short time (within a few months). After interviewing both Shipyard and Navsta personnel involved with waterfront operations, it seemed apparent that the initial trial was disorganized, lacking clearly defined goals and expectations. Responsibilities were not explicitly defined down to the appropriate levels of execution. The Memorandum of Agreement (MOA) delineated overall responsibility between Navsta and the Shipyard, but failed to expressly identify how or with what resources the individual workmen involved were to

accomplish their new responsibilities. Specifically, the issue of support services was not sufficiently addressed. Provisions for the use of Shipyard production shop equipment (testing, calibration, etc.) by WFAS personnel was not considered. One of the key reasons cited for this failure was that Production shop personnel transferred to the WFAS were cut off from their home production shops in terms of special equipment, services, and repairs. Unlike the PWAS, the personnel and equipment transferred to the WFAS came from several different production shops. This compounded the issue of which resources were available to whom. Thus, the internal organization, as well as the simplistic formal organizational structure, must be addressed directly before another attempt at a similar reorganization. [Ref. 3]

Another key issue involved the laborhour rates to be charged. The initial attempt to establish a WFAS placed it under the supervision of the Public Works Department, assuming the lesser PWD laborrate charged would be charged instead of the higher Shipyard laborrate. However, this assumption proved to be misleading. The Shipyard Comptroller has confirmed that the rate charged for personnel assigned to a WFAS would be the Shipyard rate, regardless of which Department the WFAS is assigned to. The reasoning behind this is that the Shipyard rate is based on the rates earned by the specific types of personnel and equipment utilized in

providing waterfront services. Personnel who provide waterfront area services (crane operators, riggers, pipefitters, etc.) are paid at a higher rate than personnel who perform the services provided by PWAS personnel. [Ref. 4]

III. CURRENT OPERATIONS

Based on personal observation and various interviews, overall, day-to-day waterfront evolutions are smooth and orderly. The process begins when notification is received from a ship requesting service, ranging from a ship movement to loading of supplies or equipment. The single point of contact for the ships is the Port Services Department. NAVSTALONGBCHINST 11410.1B (revision C is currently underway) provides the ships with procedures to request assistance concerning waterfront operations. To ensure the Port Services Department can provide adequate service, a 72 hour notice is requested of the ships. If the ships are in port, requests can be made orally over the phone or can be hand delivered if payment is required. (Payment is required for non-mission essential evolutions such as stores loading.) If the ships are at sea, a LOGREQ with the necessary information is sent by the ship to Port Services. Port Services coordinates the services required by the ships, sends a response message acknowledging receipt of request, and provides additional information as necessary.

The Operations Division Coordinator schedules waterfront services with Shipyard production shop 99 (Utility Services-Electricians, Pipefitters, Telephonemen). This billet is

currently filled by a Chief Petty Officer on temporary duty to the Port Services Department. The Coordinator functions as a liaison among the ships, Port Services, and the Shipyard. He is currently located in Shop 99's office with the Shop 99 Supervisor. Being centrally located within the Shipyard has provided him the opportunity to improve communications with all of the Shipyard production shops involved with waterfront operations. As ship requirements are delivered to the Coordinator, he tentatively schedules each evolution with Shop 99 in conjunction with the Shipyard's schedule. Each morning the Coordinator reconfirms the following day's requirements with Shop 99. Shop 99 combines the requirements of the Navsta and Shipyard activities and enters them into the Shipyard teletype communication system. The teletype transfers required information for specific, scheduled evolutions to all shops involved. The main Shipyard Production Shops involved with waterfront operations are Shop 72 (Riggers), Shop 64 (Shipwright), Shop 02 (Crane Service), and Shop 03 (Security Group- after hours crew). This is how each shop is notified of the impending schedule in order to ensure the availability of their personnel and equipment as scheduled. Port Services also coordinates other aspects of waterfront operations such as tugs, harbor pilots, fuel, ammunition, and the Control Tower. [Ref. 5]

Most routine evolutions run smoothly. Only ship arrivals cause occasional fluctuations in the schedule. Although it is not easy to pinpoint the exact time of arrival, experience has enabled the waterfront crew to predict arrival times with a fair degree of accuracy. As a ship arrives, a Dockmaster from the Port Services Department coordinates the evolution from the pier. He/she is in touch with Port Services, the ship, and the Control Tower. If delays are expected, the Dockmaster will notify Port Services, who in turn will contact Shop 99 and the other Production Shops involved. The Dockmaster is present for the duration of the berthing process but does not have authority over Shipyard Production Shop personnel. If conflicts arise, Port Services is contacted to resolve the situation.

When the ship finally reaches the pier and has been stabilized, the brow is set in place with the assistance of the crane crew. A crane crew consists of one crane operator, four riggers (this number may vary depending on the type of crane in operation), and a crane. It is important to note that the lift capacity provided by a crane is not specifically required to place and remove brows. However, a crane is used due to the lack of another vehicle that is capable and readily available. In addition, pursuant to all brow placements, a qualified Browman must also be present. He is responsible for the correct placement of the brow on the pier, taking into

account the ship's position relative to the pier. The evolution involved in setting the brow takes approximately 15 minutes, depending on the class of ship. Larger classes of ships may require two brows and generally take longer to berth.

Once the brow has been secured, utility cables are hooked up to the ship. This evolution involves a coordinated effort between the Shipyard shop personnel and the ship's crew. Although on most ships the cables can be moved by ship's company, a crane is usually utilized in conjunction with a cable truck to make the evolution less labor intensive. This part of the berthing procedure also takes approximately fifteen minutes to complete.

Generally, all personnel function smoothly and efficiently. However, occasional problems do surface. The majority of the problems that arise concern the allocation of crane services, which involves Shop 02 only. Difficulties occur when the priority given to services provided by the Shipyard in support of the Navsta conflict with Navsta's priorities. Two recurring examples are: (a) when a crane crew is not waiting on the pier upon a ship's arrival to engage the brow or (b) when crane crews are not available for, or are pulled away during, stores and equipment onloads and offloads. There have been numerous occasions when a crane was in the midst of loading stores and suddenly packed up and left the

pier because it was called away to another job. This is especially frustrating to the ships when they have followed Navsta established procedures to request services, and then without notice, they are left in mid-evolution without support. [Ref. 5]

Since crane assets are under the direct control of the Shipyard, it is they who delineate the priority system that is ultimately followed. Under the Shipyard's priority system, the highest priority is given to preventing work stoppages, berthing ships, and various Shipyard-scheduled activities. Loading stores is done only on an as-available basis. The ships are not sympathetic to this priority system. They are concerned with the movement of their stores, especially when frozen stores and Ship Store Retail items are involved. These items are time sensitive and highly pilferable and should be placed higher within the priority system. Thus, when a crane leaves in the midst of an evolution, there is considerable frustration and anger. These feelings are compounded when the crane leaves without notifying the ship or Port Services that the crane is required to move to another evolution. This happens for a number of reasons - emergency work stoppage, unavailability of cranes or crane operators (more frequently it is the lack of crane operators), scheduling conflicts, evolutions requiring more time than scheduled, etc. Due to the lack of a strong communication link between the ships,

Port Services, and Shop 02, problems are directed to the Navsta senior officers instead of being handled at the appropriate level in the chain chain-of-command.

IV. METHODOLOGY

Research was initially directed toward becoming oriented with daily waterfront operations. Pier operations were observed, and both the Navsta and the Shipyard paperwork trails and lines of communication were followed to identify the inner workings of the system. Since quality of service is also a major consideration of this study, customers were interviewed to determine their opinions on current services and how they could be improved. For comparison purposes, customers from Naval Station San Diego were also questioned concerning their relationship to and relative satisfaction with the waterfront services provided by Naval Station San Diego. Although

Data was obtained through personal interviews with both Navsta and Shipyard personnel from the various operational and support offices involved with waterfront operations. They were knowledgeable, professional, and helpful. Since this study addresses a possible shift of power and control of assets, research questions were met with strong and varied opinions of how waterfront area services should or should not be operated. In order to present fair and unbiased recommendations, considerable effort was given to obtaining

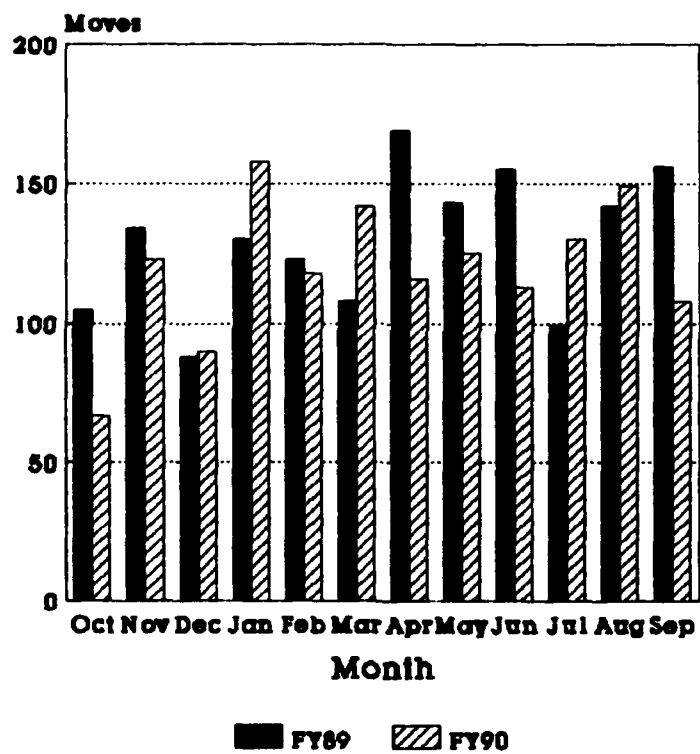
information from all members that would be affected by a change in the current operation.

The methodology used in this study was to forecast the cost that Navsta would incur, based on a typical month of operation for the Navsta Port Services Department, employing different alternatives. The resultant cost figures would then be compared to total cost actually charged during the period.

The month chosen for analysis was October, 1990. October was the most recent data that could be obtained at the outset of this study. Typically, as shown below by Figure 3, October had fewer ship movements than the other months during the past two fiscal years.

Therefore, using the month of October as a sample, any cost savings reflected would represent a conservative estimate of savings for subsequent months of operation. Each waterfront evolution that Port Services was involved with during the month of October was tracked by individual ship, ship type, date, service provided, number of crane hours utilized, and cost of the evolution [Ref. 5]. Evolutions concerning ship movements are listed in Appendix A. Ship movements include ship arrivals, departures, change of pier location, and shifts along the same pier. Evolutions concerning equipage offloads and stores onloads are listed in Appendix B.

Figure 3
Ship Moves



V. ANALYSIS

Analysis was first directed toward evaluating the current operation. Once day-to-day routines were determined, specific focus was placed on communication between the parties involved. Next, analysis was directed toward determining specific assets required to establish a Navsta-operated WFAS independent of the Shipyard, and the associated issues involved in obtaining, coordinating, and maintaining them. These requirements were then examined to determine whether establishing an independent WFAS would correct the deficiencies identified in the problem statement. Various alternatives were later explored to determine if they could better satisfy those deficiencies.

A. Communication Issues

One key aspect of the waterfront service operation that has not been addressed thus far is communication. Even with unlimited resources, an operation will not function efficiently if there are communication problems in the system. Ideally, the method in which work is performed should be refined first before new equipment or other assets are added. Otherwise, resource capacity will be wasted. Focus must be

directed toward designing a workflow process that effectively satisfies the customers' needs.

1. Customer Relations

Port Services primary mission is to provide efficient and effective service to the Fleet. In interviewing personnel from Port Services, their professionalism and desire to service their customers was readily apparent. However, efforts could be enhanced through improved communications with customers. Hence, good communication is imperative to ensure the best possible service is provided.

Long Beach customers interviewed were very different in their responses than customers of Naval Station San Diego. The latter were all very positive concerning the relationship they had with their Waterfront Shop and attributed this positive relationship to the strong "Welcome Aboard " Program pursued by Naval Station San Diego. A representative from the Waterfront Shop frequently visited ships to provide them the latest information and query for feedback concerning any problems. To determine how Long Beach customers felt about relations with Port Services, four locally homeported Cargo Officers were interviewed. All four indicated a lack of a strong relationship, and said they would like to have routine visits by Port Services personnel.

Currently, Navsta Long Beach Port Services delivers an information packet which outlines services available at Navsta to visiting and homeported ships, but this is not enough. More direct attention should be given to the homeported ships. A new, revised "Welcome Aboard" program is needed.

First, a Welcoming Officer should be appointed. It is recommended that either the Port Services Officer or the Port Services Operations Officer be appointed as the Welcoming Officer. The Welcoming Officer would function as a link between the ship and Port Services.

Secondly, the Welcoming Officer should provide each ship with a "Welcome Aboard" packet containing information on how business is conducted at Long Beach. Although a packet is currently provided by the Port Services Department, some instructions can be rewritten to enhance and clarify the services that Port Services provides and the procedures to follow to obtain these services. A questionnaire sent out to the ships requesting information they would like to see may provide a good indication of items that should be included in the packet.

Third, and most importantly, periodic visits by the Welcoming Officer to ships that are homeported in Long Beach should be made on a routine basis. This approach would provide instantaneous feedback on how the ships view the

waterfront services provided. This valuable feedback will enable Port Services to correct problems early.

The objective is to improve communication between the ships and Navsta. Assisting the ships in communicating their needs will enable Port Services to provide more efficient and professional service.

2. Formal Liaison Billet

It is apparent that a single point of contact is required to alleviate many of the communication problems between Navsta and the Shipyard. Currently, there is a Chief Petty Officer (CPO) assigned to Port Services for temporary duty functioning as a Port Services representative within the Shipyard. He has an office space within Shipyard Shop 99 which provides him direct access to the production shops involved with waterfront operations. Specifically, he coordinates requirements for waterfront evolutions (both ship movements and stores/equipment loads) received by Port Services and transfers them to the Shipyard production shops. The CPO has been in this billet for approximately six months. Since that time communication between Port Services and the production shops has noticeably improved. However, this billet can be expanded to produce an even greater improvement.

A billet should be established and filled with a dedicated, senior enlisted person (E-7) on permanent duty.

Emphasis is placed on this billet being filled by a person who is on permanent duty. This liaison officer should be positioned inside the Shipyard as the CPO is currently, to ensure Navsta priorities are incorporated into Shipyard planning. He/she should have a basic understanding of the Shipyard Production Shops' activities and the authority to provide the quality of service that is demanded by the fleet. The liaison officer would be responsible for coordinating and scheduling the assignment of cranes (or any other material handling unit used) as required for berthing services, as well as stores and equiptage lifts that are not incident to berthing. The ship's payment (on DD Form 1149) would be forwarded via Port Services directly to the liaison officer who would schedule the lifts, calculate appropriate costs, and forward documentation for payment. [Ref. 6]

3. Communication at the Job Site

To further improve communications between Port Services and the Shipyard production shops, extending the use of current hand-held radio units to enable direct communication between the Dockmaster, Port Services, Control Tower, and Shop 99 is recommended. [Ref. 6]

Currently, Dockmasters on the pier must contact Port Services in order to contact the production shops or the CPO Liaison Officer. This encumbers communication, slowing down

service. Port Services personnel have a walkie-talkie system that might be able to be converted to extend its capacity. Otherwise, there are several hand-held communication systems currently on the market which would pay for themselves by improving communication and preventing avoidable delays.

B. REQUIREMENTS FOR ESTABLISHING A NAVSTA WATERFRONT AREA SHOP

One of the primary questions Navsta desires to be answered is: What are the specific requirements needed to establish a Navsta-operated Waterfront Area Shop that would be independent of the Shipyard? Although a previous attempt had failed, the issue to establish a WFAS has been proposed again.

The proposal to establish an independent shop involves transferring control of assets and responsibilities from the Shipyard Production shops to Navsta's Public Works Department (PW) or Port Services Department (PS). It is vitally important to note that establishing a WFAS requires considerably more than just the physical transfer of assets. The asset requirements and issues involved with such a commitment must be carefully determined before a commitment is made. The objective of this section is to satisfy this requirement. A list of requirements and associated considerations, followed by brief discussions, were developed by combining the expertise of the Port Services Officer, the

Port Services Operations Officer, and various Shipyard production shop supervisors. To effectively transfer the control of the waterfront services, the following pertinent issues must be addressed:

1. Mission Description

The first step is to determine a precise mission description of the services to be provided and where this entity will fit into the chain-of-command. Outlined below is a list of services to be provided:

- Prepare berths for ship arrivals.
- Place brows and platforms for arriving and departing ships from non-shipyard piers.
- Provide shore and power cable hook-up/disconnect assistance.
- Coordinate off/onload of aviation and other equipment.
- Coordinate loading of supplies. (Higher priority should be given to frozen stores and Ship Store Retail items.)
- Arrange and control ships' ammunition handling in port.
- Maintain ships' arrival and departure data.
- Prepare daily Ships' Movement List.
- Publish and distribute Ships Present List.
- Provide ships' allowance vehicles and rentals in excess of ship's allowance.

NOTE: It is assumed that the Shipyard will continue to provide the following:

- Services to ships docked at Shipyard piers
- Hazardous waste collection, storage, and processing

The initial attempt in FY89 to establish a WFAS placed it under the supervision of the Public Works Department. This was done for two reasons. First, the WFAS was treated as an extension of the Public Works Area Shop (PWAS) program. This program involved the transfer of personnel from the Shipyard to Navsta to function as a dedicated shop for Navsta initiatives. Secondly, it was assumed by placing the WFAS under Public Works, the PWAS personnel laborhour rate would be charged instead of the higher Shipyard laborhour rate. However, the Shipyard Comptroller confirmed that the laborhour rate charged for personnel assigned to a WFAS would be the Shipyard rate, regardless of which Department the WFAS is assigned to. The reasoning behind this is that the Shipyard rate, currently \$53.97/laborhour, is based on the rates earned by the specific types of personnel that are utilized in providing waterfront services. Personnel who provide waterfront area services (crane operators, riggers, etc.) are paid at a higher rate than personnel that perform the services provided by the PWAS.

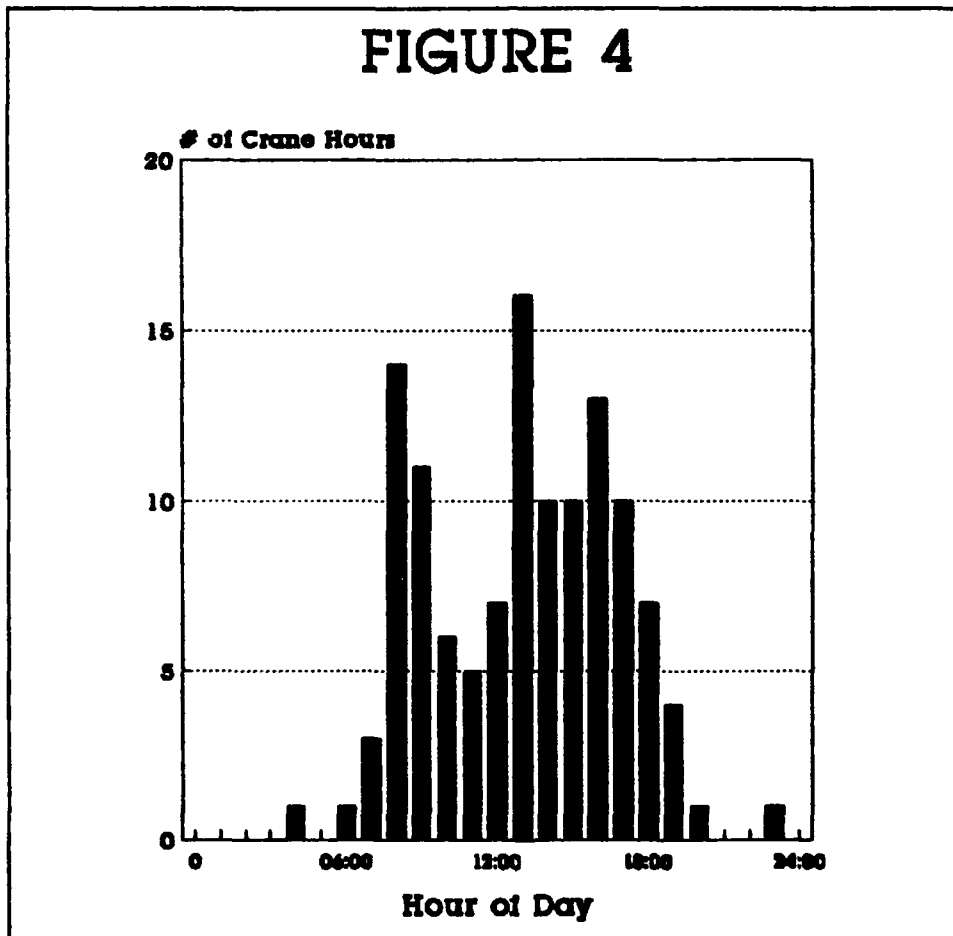
Therefore, the initial reasoning that guided the placement of the WFAS under the Public Works Department no longer applies. Since the services listed above are basically a subset of those currently provided by the Operations Division of the Port Services Department, any new attempt to establish an independent WFAS should be placed under the jurisdiction of the Port Services Department, rather than the Public Works Department.

2. Hours of Operation

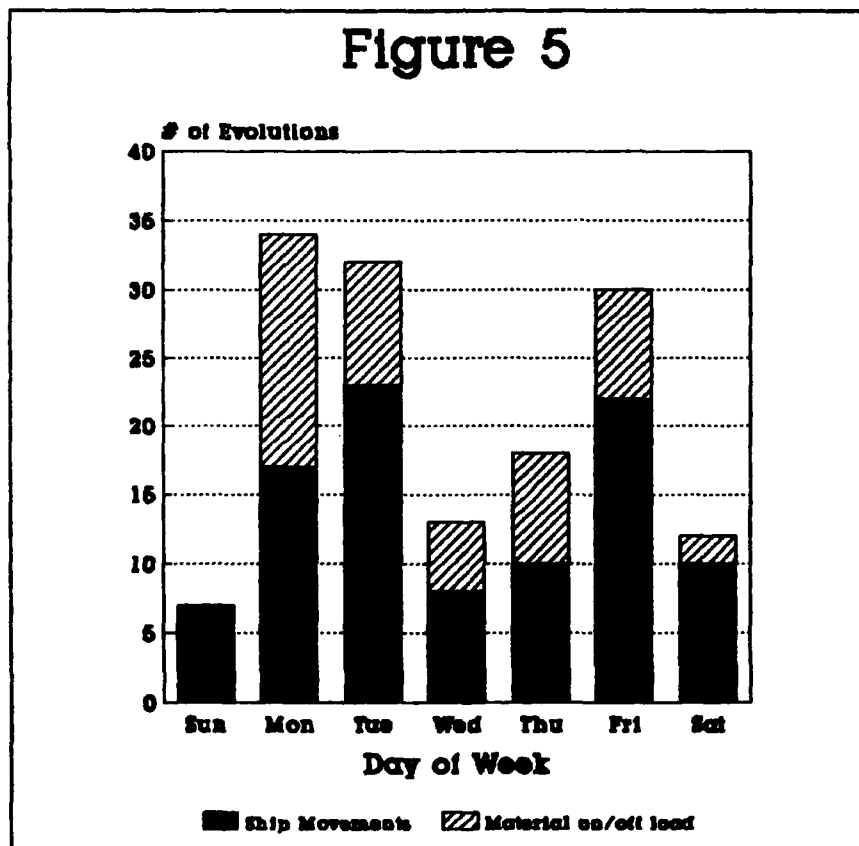
The services listed in paragraph one above must be provided twenty-four hours a day. However, whether the WFAS should operate around the clock bears closer scrutiny. There are several alternatives to the WFAS providing 24 hour coverage. One option is to restrict ship movements between specified hours such as 2200 through 0630. Such restrictions would reduce labor requirements and hence, overall costs. However, imposing or mandating rigid restrictions on customers is not considered necessary at this time. Negative impacts on customer service should be avoided. Secondly, although timely ship movements should be encouraged to reduce overtime expenses, the alternative promoted herein is to have the WFAS cover prescribed hours, such as 0600-1830 Monday-Friday. These hours would best be covered by two overlapping shifts (i.e., 0600-1400 and 1030-1830). The Shipyard Security Group

after-hour crew (Shop 03) would handle ship movements occurring outside this timeframe, as it is doing currently.

The benefits of operating Monday through Friday are numerous. Justification for a modified time schedule can be seen by graphing the information contained in Appendices A and B on bar charts, as illustrated in Figures 4 and 5. Appendices A and B track ship movements and crane hour usage for on/off-loads, respectively. The data used are for the month of October 1990 and depict ship name, ship type, date



and time of evolution, type of evolution performed, number of hours required, and the cost. Plotting this data on bar charts, as illustrated in Figures 4 and 5, it is obvious that the majority of evolutions occur within the well-defined time period of 0600 to 1830. Figure 4 depicts the number of crane hours used for ship movements in one hour increments. Using the time frame previously mentioned of 0600-1830 as boundaries, we find that 92% of crane service hours utilized for ship movement operations in October fall within this window. Figure 5 shows the distribution of evolutions by day



of the week. Again, a predominant portion, 87%, of the total number of evolutions, fall within the Monday through Friday time frame.

Around-the-clock coverage is costly and unnecessary. This is particularly true when when a strong alternative, Shop 03, is available to handle evolutions outside this timeframe. Shop 03 has never had difficulties in the past nor are any potential problems expected in the future. If Shop 03 is not utilized, three shifts a day would be required to cover a full 24 hours. A proposal was devised using 10-hour shifts and a 4-day workweek. However, neither the union nor the Navy currently allows such a shift. Either way, 24-hour coverage would result in significant idle time. This would not be cost effective or an efficient use of resources. Hence, operating hours have a considerable impact on the determination of asset requirements as well as other criteria addressed herein.

3. Equipment Asset Requirements

Asset requirements are presented for a single shift [Ref. 8]:

- one crane with at least an 80-ft boom
- one 15,000 lb fork truck
- one 6,000 lb fork truck
- one cable handling truck with boom
- one hose and reel truck

- various hoses and cables for water, electrical, telephone hookups

- various slings, straps, and handling gear for crane and handling truck with boom use

- brows, gangways, platforms, ceremonial platform, vehicle ramp, marine vehicle ramp, etc.

NOTE: A more detailed list of essential waterfront support equipment and proposed quantities necessary to support a waterfront operation independent of the Shipyard is outlined in Appendix C. This list should not be considered all-inclusive, as it does not address small support items such as plugs, line, adapters, etc.

Determining asset requirements is difficult. There must be room for flexibility and substitution, should specific items be found unavailable. Shipyard requirements may preclude transferring equipment to a WFAS. It is also important to note that unserviceable items were included in several equipment item inventories from Appendix C, decreasing the quantity readily available for use.

Purchasing all items not currently owned by the Navsta would be financially prohibitive. In addition, the duplication of assets is not in the Navy's best interest and is expressly prohibited by Navy directives (OPNAVINST

11000.16). However, a combination of sharing or renting the more expensive items and purchasing low-cost items is a viable alternative. Since sufficient assets are currently available to provide adequate waterfront services, efforts should be directed toward acquiring them from the Shipyard, rather than attempting to duplicate assets. The specific combination of resources will need to be defined and agreed upon by the Navsta and the Shipyard.

First the status of each of the equipment items listed previously will be addressed briefly. However, the issue of a crane is the most important item and will be discussed in more detail.

-Port Services already owns a forklift with a 6,000 lb capacity. No further effort is required.

-The Shipyard has both a cable handling truck with boom and a cable and reel truck in their inventory. However, they may not be willing to turn these items over to the Navsta as both are utilized extensively within the Shipyard. An alternative to purchasing these items should be considered, since both items are expensive and would be idle more than in use.

-A number of hoses and cables may be obtained from the Shipyard; others will need to be purchased.

-Slings, straps, and handling gear would only be needed if Navsta purchased its own Gradall Material Handler. (This issue is addressed in detail below.) If a Shipyard crane is

utilized, whether rented on an "on-call" basis or transferred permanently, these items should accompany the crane supplied by Code 02 (Crane Services).

-In the case of brows and platforms, an adequate number are currently available for the ships. Thus, there should be no need to purchase more. They should be obtained from the Shipyard when required without cost to the WFAS.

The most difficult asset requirements involved in establishing a WFAS are the crane service assets. A proposal to purchase a crane has been put forward, but this proposal has numerous problems which preclude it from being a strong option. Aside from not being economically feasible, it violates Navy directives. In addition, purchasing a crane would still require qualified crane operators, riggers, maintenance requirements, and safety inspections. (These specific manpower issues regarding cranes will be addressed in more detail in the next section.) Thus the proposal to purchase is not considered a realistic option at this time. However, there are several viable alternatives: (1) requesting crane service on an "as required" basis, as is currently being done; (2) transferring a crane and an entire Shipyard crane crew(s) to the WFAS; or (3) exploring alternatives to the crane.

The first alternative does not deviate enough from

current operations to warrant expectations that it would remedy the problems identified.

The second alternative, to transfer an entire crane crew is definitely a viable solution. However, there are several drawbacks associated with this alternative. The cost of "renting" a crane full time would be considerably higher than paying for it only when it is utilized, as is done currently. This would result in paying for idle time. There would also be instances when two cranes would be required simultaneously, but if Navsta severs ties with the Shipyard, there is no motivation for it to make another crane available to the WFAS. Customer service would be impacted negatively if customers had to wait while a crane was made available. Another issue is the Shipyard's willingness to completely surrender use of one crane and a number of crane crews (the number of crews required depends upon the hours of operation chosen). Given the options of ordering a crane each day or having a specific crane and crew permanently assigned to the WFAS, the latter option is preferred. It is better both in terms of continuity and control.

The third possibility, to explore possible alternatives to the crane, is the most promising. The best option found is the Gradall Material Handling Unit. The Gradall will be discussed in more detail later in the Analysis section of this report as an alternative crane resource

solution. A Gradall does not have the same capacity as a crane, so it can not perform all the functions a crane is capable of. Still, it can provide most of the services required by a WFAS. Also, a Gradall is faster and more mobile than a crane and it can be operated by one sailor. When additional capacity is needed, a crane could be utilized. Currently, cranes are used, not because their capacity is specifically required, but because they are readily available. Issues involving crane service resources will be discussed frequently in this report, since many of the problems identified are directly related to these resources.

4. Manpower Asset Requirements

Similar to the determination of equipment assets, manpower assets are presented for a single shift [Ref. 8].

- one browman/gangwayman
- one foreman
- one crane operator
- two/four riggers (depends upon type of crane used)
- two electricians
- two pipefitters
- one telephoneman/electrician

Important factors that must be taken into consideration concerning manpower assets are the restrictions

imposed by the union. Their rules are considered absolute. The Navsta may choose to challenge any issue separately on its own accord. There were many proposals concerning the complement of personnel required to establish a WFAS. However, several of these proposals did not account for union rules. Several specific considerations that require attention are:

- Union crane operators are prohibited from working with non-union riggers. Therefore, sailors can not function as riggers, if a union crane operator is used.

- The proposal to train sailors as crane operators is not conceivable from every aspect - training, safety, efficiency. Even if a sailor were trained as a crane operator the Shipyard would not allow him/her to operate their equipment. Therefore, the transfer of a crane to the WFAS would have to include a civilian crane crew.

- Personnel billets in the WFAS should be permanent assignments rather being filled on a rotating basis by a manpower pool. Quality of operation is directly proportional to continuity and loyalty, which is best obtained by a cohesive team.

- A back-up system for personnel will be required to support leave, emergencies, and sick-leave.

-Currently civilians operate on an 8-hour workday. There have been several proposals to have 10-hour, four-day workweeks. However, this schedule is prohibited by both the union and the Navy.

-The list of personnel requirements included a browman. The shipyard has only one such person. Either a dockmaster, foreman, or other WFAS personnel will need to be trained to perform the functions of a browman or the shared services of the Shipyard's browman will need to be obtained.

Sailors can be trained to perform many functions. However, there is a limit to the type of skills they should be performing. There is also a limit to the number of functions that the sailors currently assigned to the Port Services Department can absorb safely, without increasing the number of permanent duty personnel. The most important criterion of the WFAS proposal to consider is whether the added cost of having an independent crew is commensurate with the expected increase in service to the fleet.

5. Support Services

Attention must be directed toward determining responsibility for support services such as repair and preventive maintenance. Currently maintenance on the Port Services-owned forklift is performed by the Shipyard

Transportation Department (Public Works) at its shop [Ref. 9]

No major difficulties have arisen with this arrangement, and they are best suited to perform this function. However, such responsibilities contributed to the downfall of the previous attempt to establish a WFAS. Although it was outlined in the MOA that WFAS personnel were responsible for conducting minor preventive maintenance, equipment required to perform testing was not made available to them from the production shops. Essentially, WFAS personnel were cut off from essential Shipyard support. Repair responsibilities were assigned to the Shipyard, however, timeliness of repair service and availability of replacement equipment had not been adequately addressed, and difficulties ensued. Problems that arose were frequently due to internal organizational strife. Therefore the key point to address is when responsibilities are assigned. Logistical issues must not be separated from the operational aspects.

6. Damaged, Lost, and Obsolete Equipment

The determination of responsibility for replacement of damaged, lost, or obsolete equipment originally obtained from the shipyard must be identified. Charges associated with replacement of damaged or lost equipment should be dealt with on a case-by-case basis, depending on the amount of control the WFAS had over the equipment. However, the cost to replace

obsolete equipment should rest with the Shipyard since a percentage of "rental" charges include repair and replacement.

7. Billet Descriptions and Responsibilities

This responsibility naturally rests with the Port Services Department should the WFAS fall under their supervision within to the chain-of-command. All billet descriptions and responsibilities should be in writing and made available.

8. Safety Concerns

Responsibility for safety inspections and enforcement of safety standards pertaining to Navsta-owned equipment would be the sole responsibility of the Port Services Department/WFAS personnel. Equipment owned by the Shipyard and utilized by the WFAS is more complicated. The responsibility for ensuring compliance and enforcement of the safe operation of the equipment rests with WFAS personnel. Periodic physical safety inspections can be performed and recorded either by qualified WFAS personnel or by the Navsta civilian Safety Manager (Mr. Tom Cummings) [Ref. 9]. Safety inspections will be required for crane (or equivalent), truck, and forklift assets.

9. Excess Demand

Obviously all ties with the Shipyard can not be broken. Assistance will be required when surges in demand occur, with nested ships and ships located at Shipyard piers. By establishing an independent, Navsta-operated WFAS there is no incentive for the Shipyard to provide extra assistance. However, it would be conducive to establish a contingency plan for such an event, should the need arise. Reference to such a plan should be included in a new Memorandum of Agreement (MOA) prior to the establishment of a WFAS.

C. DISCUSSION OF WFAS PROPOSAL

The proposal to establish an independent Navsta-operated WFAS is prompted by the desire for more autonomy in providing fleet support. A Navsta-operated shop would produce a dedicated shop, specifically designed to meet Navsta requirements and priorities. The assumption is that this would in turn enable Navsta to provide improved service to the fleet. There is no question that a Navsta operated WFAS can be established. However, the question remains whether establishing such a shop would improve service and be cost effective. Since the consistency of assets would remain relatively the same, it is doubtful whether such a change would significantly alter operational efficiency.

During the research phase it was evident that most of the friction between Navsta and the Shipyard revolved around the control and allocation of crane operation resources, not with the remainder of the Shipyard production shops involved in waterfront operations. Specifically, the primary functions involving crane service resources that require improvement are brow placement and removal, and short-notice supply onload evolutions [Ref. 8]. Therefore, added attention was directed toward evaluating this issue and developing alternatives.

Crane service resources are a key factor in the decision of who, how, and when waterfront services are provided. Due to unavoidable constraints placed on crane service assets total independence from the Shipyard is not possible.

D. VIABLE ALTERNATIVES FOR PROVIDING WATERFRONT SERVICES

After researching feasible solutions, the number of viable alternatives narrowed to three: establish a Navsta-operated WFAS as outlined earlier in the requirements section, continue with current operations, or purchase a Gradall material handling unit in conjunction with expanding current hours of operation.

The alternative to establish a separate Navsta-operated WFAS is still an option to be considered. However, as discussed in the last section, this option does not directly address underlying reasons for the problems identified. This proposal will not produce the increase in control or improvement in customer service desired. Therefore it is not strongly recommended.

One alternative is always to continue with operations as they currently exist. Attention could be directed toward changes to improve communications, leaving the operational aspects of waterfront services as they are. However, research has indicated that operational efficiency can be improved. With impending budget cuts it is imperative that measures be taken now to ensure that adequate support can be provided in the future. Therefore, remaining with current operations is an option, but better possibilities exist for future benefit.

The third alternative is the strongest of the three and involves combining several ideas. Since much of the problems

focus on the control and allocation of crane service assets, an alternative to this particular resource is needed to reduce the dependency on them. A Gradall material handling unit offers an excellent alternative to a crane. It does not have the capacity of a crane but it is capable of performing most of the jobs required by Port Services. By incorporating a Gradall material handling unit into current operations, Port Services will gain the flexibility and control desired. Since a Gradall can be operated by one person from Port Services, they will no longer be restricted to scheduling operations around the availability of Shipyard cranes. The specific details for this alternative are outlined in the following chapter.

VI. ECONOMIC ANALYSIS OF THE GRADALL MATERIAL HANDLING UNIT

The Gradall Material Handling Unit will first be presented by examining its features, potential utilization, and advantages of its use. The 534B Model has been chosen for this study because this model best satisfies the boom and weight capacity requirements needed by Port Services, while taking into consideration cost constraints. Each Gradall unit is basically the same in overall design, but different models have varying combinations of boom and weight capacities. The general benefits outlined in this chapter apply to all Gradall models regardless of the specific model chosen.

A. FEATURES

This equipment combines the features of a forklift truck with a telescopic boom. It is operated by one person and can handle a wide variety of jobs. This machine was designed to meet the requirements of contractors engaged in all types of construction. It has higher lift capabilities, greater lift capacity, greater forward reach, and more standard features than any lift vehicle currently in use at the Navsta. With the addition of various attachments, the number of applications for which the Gradall can be used increases

significantly. It can be utilized for waterfront operations as well as for other applications on the Naval Station.

The two basic difference between the various models is the range of the boom and the total lift capacity of the unit. The 534B model has a lifting capacity of 9,000 lbs. and a lifting height of 36 feet. Another model that might be considered is the Gradall 544. It has a 10,000 lb. capacity and a lifting height of 48 feet (almost five stories high). When evaluating total capacity, it is important to note that as the boom extends outward, the total weight that can be lifted is decreased. For example the maximum weight capacity of the 544 at full extension of 48 feet is only 4,000 lbs. Each unit outfitted with a hydraulic valve attachment costs \$73,800 and \$91,250, respectively.

The Shipyard currently has a Gradall 542 in operation. However, this particular model is not considered an option in comparison with the other models mentioned because it only has a boom expansion of 24 feet. It does however have a higher weight capacity of 15,000 lbs, but the list price is \$38,000 more (almost a 50% increase).

Figure 6 provides an illustration of the Gradall 534B model. See Appendix D for a complete list of standard features, available attachments, and related costs [Ref. 10].



534B-9

FOUR-WHEEL DRIVE
ROUGH TERRAIN
90° PIVOT STEER
9,000 LB. CAP.
36' LIFT HEIGHT

GRADALL®
MULTI-PURPOSE MATERIAL HANDLER

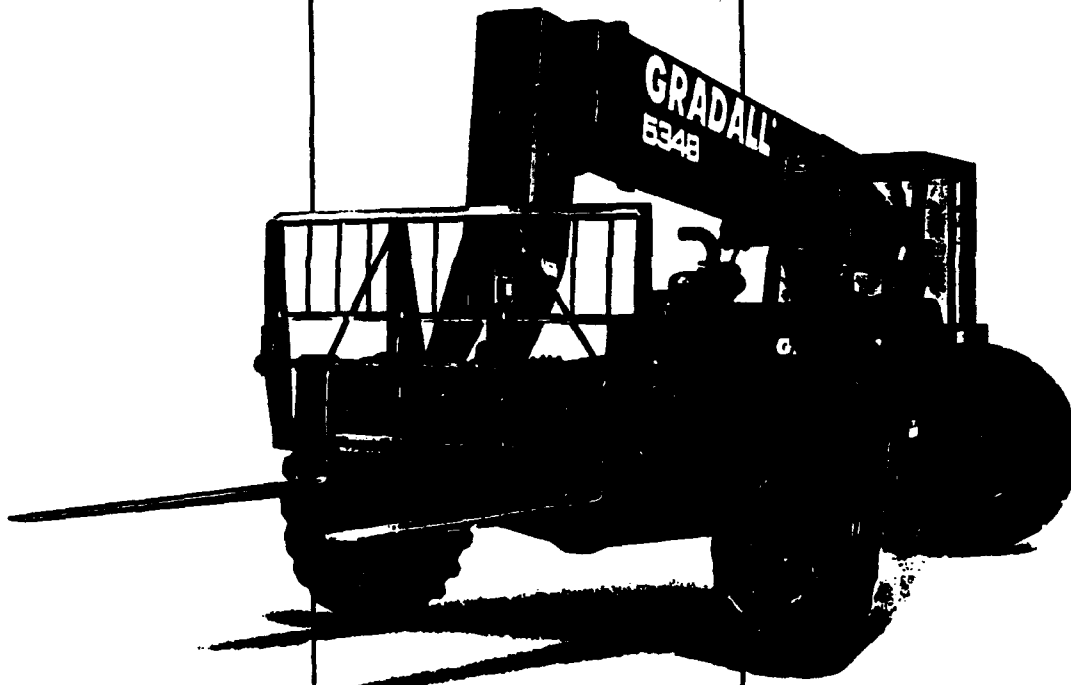


FIGURE 6 - Picture of Gradall 534B Material Handler

B. POTENTIAL UTILIZATION

The Gradall can be used on all FF, FFG, DD, DDG, CG, CGN and AOR class ships for brow placement and removal. Although amphibious ships (LHA, LST, LPD, LKA, LSD) do not require crane service for brow placement and removal, most of these ships can utilize the Gradall for stores and equipment onloads and offloads within specified weight restrictions [Ref. 5]. The Gradall is particularly convenient for the FF and FFG class ships, which comprise approximately 42% of the total number of ships homeported at Long Beach. An automatic fork leveling feature keeps the forks at a constant angle with the ground. Combining this feature with its retractable booms it can load stores right onto the fantail with relative ease.

The Gradall can be used on piers E, 7, 9, 15, and 16. However, ships berthing at pier 6 or moored outboard of another ship (nested) would not be able to utilize this equipment.

C. ADVANTAGES OF THE EQUIPMENT

Three distinct advantages would be gained by the Navsta by purchasing this equipment: (1) independence and control over an asset that can provide most of the services required; (2) improved service to the customers - the ships; and (3) significant cost savings would be realized. The only disadvantage foreseen to the Navsta concerning this equipment

is the initial purchase price. However, in comparison to the savings in both crane rental costs and improved customer service, the initial purchase cost proves to be negligible.

First, the Gradall can be operated by one sailor from Port Services with a minimal amount of training (two hours). This enables the Navsta to be less dependent upon the Shipyard for availability of crane services. As discussed earlier, most of the crane functions currently being utilized do not require the full capacity of a crane and can easily be accomplished by the Gradall. By utilizing the Gradall for these functions (brow placement and removal, stores onload, etc.), the demand for cranes will be reduced, making them more readily available for functions that specifically require the capacity of a crane.

Second, improved control over scheduling and the exclusive availability to the Navsta of the Gradall for waterfront area services, would result in improved responsiveness and timely service. Customer satisfaction and overall customer relations would also improve.

The third benefit to the Navsta would be the significant cost savings realized by utilizing Port Services personnel, rather than hiring an entire crane crew. The opportunity cost of assigning enlisted personnel from Port Services to operate the Gradall is negligible, since a Port Services Dockmaster must be present for each evolution regardless of whether a

Gradall or a crane is used. A crane crew generally consists of one crane operator and two or four riggers, depending upon the type of crane in operation, which costs the Navsta a standard hourly rate of \$163.14. Included in this standard rate are charges for equipment usage, personnel costs, travel time to and from the lift site, and a percentage toward capital reinvestment. This entire fee can be saved by the Navsta and reinvested into their own waterfront operation.

D. BENEFIT - COST ANALYSIS

For the purposes of this study, requests for Shipyard crane services by Navsta in the month of October 1990 were evaluated. The approach presented attempts to identify and measure quantitatively both benefits and costs [Ref. 11]. Appendices A and B provide the complete list of ship movements and material loads during the month respectively. Both appendices were developed from information obtained from Port Services [Ref. 5]. Each evolution is tracked by ship name, ship type, date, function to be performed, hours of crane service required, and associated costs. Evolutions that cannot utilize the Gradall are identified with an asterisk. Explanatory codes are also identified and defined.

Benefits

Table A summarizes the data from Appendix A to illustrate the evolutions the Port Services Department could perform utilizing a Gradall Material Handler rather than employing crane service from the Shipyard.

TABLE A

of ship # of crane
movements service hrs \$ cost

| | | | |
|--|-----|-----|------------------------|
| Actual Figures: | 108 | 117 | \$19,087.38 |
| Figures Assuming Utilization of One Gradall: | | | |
| Movements that did not require crane service | 29 | 0 | \$ 0 |
| Movements which cannot utilize the Gradall | 29 | 44 | \$7,178.16 |
| Reasons: | | | |
| -Ship type or pier locations | 6 | 9 | \$1,468.26 |
| -Both crane service and a Gradall 534 would be utilized due to simultaneous ship movement* | 5 | 6 | \$978.84 |
| -Movement occurs after normal working hours* | 6 | 10 | \$1,631.40 |
| -Movements occurring on weekends and holidays | 10 | 17 | \$2,773.38 |
| Total Movements that can utilize the Gradall: | 50 | 73 | \$12,235.50 (64.1%) |

* The assumption is made that a qualified Dockmaster will be onboard between the hours of 0600-1830 Monday through Friday.

The result is a total costsavings of \$12,235.50, which is a savings of 64.1 percent. Additionally, the cost per hour of crane service includes travel time (for the crane to get to each pier) and set-up time upon arrival. Since the Gradall will only operate on the Navsta piers and not be required on

the Shipyard installation, it can move from one location to another quicker and setup faster.

A savings of 64.1 percent is sufficiently cost effective. However, this savings can be increased further by establishing the following two policies:

(1) Stagger departures- four of the five ship movements would require the use of both crane service and a Gradall, due to simultaneous movement of ships. This could be accomplished by the Gradall alone if the ship departures could be lagged from 30 to 45 minutes. This would add five hours and \$815.70 to the initial savings tabulated.

(2) Extend hours of operation- Table A-1 was derived under the assumptions that Dockmasters would be scheduled into two shifts in order to ensure a qualified Gradall operator was available between 0600 and 1830, Monday through Friday. During October, there were 10 ship movements on weekend days. If hours of operation were extended to include 0600-1830 on weekends, evolutions which utilized 17 crane service hours at a cost of \$2,773.38 would have been avoided. Also, if Port Services extended hours to 1930, then two more movements could have been serviced by the Gradall for an additional savings of four crane hours and \$652.56. It should be noted that even the adoption of the Gradall only during current working hours would achieve an improvement in efficiency, customer service, and cost savings.

Additional benefits would be realized if the Gradall were utilized to onload and offload stores and equipage. Due to reduced funds for these services, the ships have been forced to utilize a greater percentage of their OPTARs over the years to reimburse Navsta for on/off-loads not considered mission essential. Either the ships would not be charged for the service if the Gradall were used, or Navsta would receive funds for transferring stores rather than paying the Shipyard for utilizing the crane. Although the Gradall is not capable of unloading or offloading material on all types of ships, it can be used on a significant portion of them. Appendix B lists crane service requests to on/off load stores or equipment. Similar to Appendix A, the evolutions that could not be serviced by a Gradall have been annotated with an asterisk. The evolutions from Appendix B have been summarized as follows:

Actual Onloading and Offloading Costs Incurred

Total crane service hours utilized.....90.5

Total associated dollar costs charged....\$14,764.17

If the Gradall Material Handler were utilized

Total crane service hours avoided.....35.0

Total dollar savings.....\$5,709.90

Savings as a percentage of total costs charged: 38.7%

Costs

Three types of costs were evaluated for this study: (1) initial investment in equipment; (2) associated life cycle costs; and (3) various additional costs.

An initial investment of \$80,700 is required to purchase the Gradall 534B Material Handling Equipment with four accessory attachments (auxiliary hydraulic valve, swing carriage, outriggers, and an instant hook). A detailed list of standard specifications, accessories, and attachments is provided in Appendix D. Note that prices are subject to manufacturer's price at time of sale.

The second cost category evaluated was the long-term life cycle costs. Navsta would be responsible for all operating, maintenance, logistics support, and safety requirements for the Gradall. These costs are expected to total \$90 per month. This figure is the average costs incurred by the Shipyard for the single Gradall 542 Model they own and have operated for the past eighteen months. This figure is consistent with the manufacturer's expected costs. The company offers an initial training session for a \$125.00 fee. (This fee is negotiable.) Further training can be conducted in-house at negligible cost. All spareparts on the Gradall unit are standard items, and do not require Gradall manufactured spare parts be used. This makes maintenance repairs much easier to perform "inhouse".

If desired the company will put together a spare parts package. The items included in this package should be incorporated into the Navsta Supply Department repairable listing to ensure adequate future spares support.

The third category involves additional costs that would surface were a Gradall to be implemented. One such cost involves coverage of a Browman. (A Browman must be present when a brow is placed upon arrival of a ship.) A Browman is still required for brow placement, although not for brow removal, and the only qualified Browman is currently employed by the Shipyard. A Browman is required for approximately one-half hour per brow placement evolution. The standard rate per man-hour for FY91 is fixed at \$53.97. Hence, additional costs pertaining to a Browman should be deducted from the total savings:

$$24 \text{ evolutions} \times .5 \text{ man-hr/evolution} \times \$53.97 = \$647.64$$

This additional cost could be avoided if a Port Services' Dockmasters were trained as a Browman. This training is encouraged to take advantage of the increased independence afforded by the Gradall.

Another issue to consider is movement of lines and hoses associated with hotel services (power, electric, phones) when a ship arrives or departs. Currently, cranes assist in the

movement of these lines when a ship arrives and departs. Although this evolution can be accomplished manually with the ship's crew, using the crane is the preferred method. The assumption is made that the coordination of hotel services can continue to be performed by the Shipyard Production shops. There have been no problems previously with their services, so a change is not deemed necessary. The Gradall can be utilized to assist in the movement of the lines if desired or the Shipyard's cable handling truck with boom can be used. The Shipyard's cable and reel truck can also assist with the linehandling aspect.

An alternative that benefits the Navsta, while having a negative impact on the Shipyard, may not be beneficial to the Navy as a whole. Thus, costs to the Shipyard from implementing this alternative should also be evaluated. The Shipyard will lose revenue from lost crane service "sales." However, the reduction in crane usage by the Navsta compared to the total usage within the Shipyard is relatively small. (Four out of 16 portal cranes, five out of ten truck cranes, and none of the 28 bridge cranes are available for Navsta use [Ref. 12].) Hence, availability of the cranes will increase, but they will not be rendered idle.

All benefits and costs incurred by the Navsta by purchasing a Gradall are summarized and forecasted for an expected useful life of 10 years in Table B. A salvage value

of zero is assumed in year 10. Cost figures have been discounted by a present value rate assuming a 10% cost of capital per OMB directives, and do not account for the effects of inflation. However, with the possibility of U.S. Naval ship forces decreasing in the future, this chart may need to be adjusted accordingly, showing a decrease in savings.

| TABLE B | \$ /month | Year | | | | |
|--|-------------|----------------|--------------|--------------|--------------|--------------|
| | | 0 | 1 | 2 | 3 | 4-10 |
| Expected Savings utilizing one Gradall 542 unit: | | | | | | |
| *Ship Movements | \$12,235.50 | | \$146,826.00 | \$146,826.00 | \$146,826.00 | \$146,826.00 |
| *Stores on/off loads | \$ 5,709.90 | | \$ 68,518.80 | \$ 68,518.80 | \$ 68,518.80 | \$ 68,518.80 |
| Expected savings: | | | \$215,344.80 | \$215,344.80 | \$215,344.80 | \$215,344.80 |
| Expected Additional costs: | | | | | | |
| *Initial purchase | | (\$80,700.00) | | | | |
| *Training | | (\$125.00) | | | | |
| *Other LCC | \$90.00 | | (\$1,080.00) | (\$1,080.00) | (\$1,080.00) | (\$1,080.00) |
| *Browman | \$647.64 | | (\$7,771.68) | (\$7,771.68) | (\$7,771.68) | (\$7,771.68) |
| Total expected costs | | (\$80,825.00) | (\$8,851.68) | (\$8,851.68) | (\$8,851.68) | (\$8,851.68) |
| Total expected savings | | (\$80,825.00) | \$206,493.12 | \$206,493.12 | \$206,493.12 | \$206,493.12 |
| Present value factor | | 1.00 | .9091 | .8265 | .7513 | 3.66 |
| Present value | | (\$80,825.50) | \$187,722.90 | \$170,666.56 | \$155,138.28 | \$755,289.89 |
| Net present savings | | \$1,187,992.60 | | | | |

If a Gradall 544 unit were purchased, the net present saving would be \$1,170,042.60. This is a difference of \$17,950.

E. OVERVIEW

The Gradall can not accomplish all functions that the Shipyard cranes currently provide, but it can perform a significant percentage of the tasks both faster and less expensively. This equipment could reduce the cost to the Navsta associated with ship movements by 64.1 percent, as well as the cost of loading stores and equipment by 38.7 percent. The cost of initial purchase, set-up, and operation would be recouped within the first month.

Incorporating a Gradall material handling unit with Port Service's current capabilities would decrease the demand for crane service from the Shipyard, eliminating most of the current crane availability problems. In addition, since the Gradall can be operated by a Navsta Dockmaster, Port Services would have better control and flexibility over scheduling. Improved control over scheduling would enable Navsta to provide more responsive and timely service for a lower overall cost. Hence, both quality and efficiency will improve leading to greater customer satisfaction.

VII. RECOMMENDATIONS FOR ACTION

RECOMMENDATION 1: ESTABLISH A COMPREHENSIVE "WELCOME ABOARD" PROGRAM

Strongly recommend a new "Welcome Aboard" Program be established. Items to be included in this program include:

- Assigning a designated Welcoming Officer.
- Visit the homeported ships on a regular basis.
- Establish an ongoing relationship with the ships that encourages feedback.
- Develop a new Welcome Aboard Packet.

RECOMMENDATION 2: ESTABLISH A FORMAL LIAISON BILLET

Establish a formal liaison billet in the Shipyard to serve as a communications link between the Port Services Department, Shipyard Production Shops, and Fleet ships. It is further recommended:

- The billet be filled by a permanent duty senior enlisted person.
- The Liaison's office be located in Shop 72 (where the CPO's office is currently).
- The Liaison be responsible for scheduling the Gradall and crane service requests.

-All DD 1149's should be routed to and processed by the Liaison.

-A job description should be written outlining specific duties and the proper authority granted to enable those duties to be carried out.

RECOMMENDATION 3: IMPROVE CURRENT RADIO COMMUNICATION SYSTEM

To further improve communications between Port Services and Shipyard production shops, extend the use of current hand-held radio units to enable direct communication between the Dockmaster, Port Services, Control Tower, and Shop 99.

RECOMMENDATION 4: PURCHASE A GRADALL MATERIAL HANDLING UNIT AND EXPAND THE SERVICES & HOURS PROVIDED BY PORT SERVICES

It is recommended that the Navsta:

-Purchase one Gradall 534B Material Handling Unit along with the attachments listed in Appendix C.

-Train Port Service Department Dockmasters to operate the Gradall unit.

-Modify hours of operation to provide for the availability of a trained Gradall operator between the hours of 0600-1830 Monday-Friday.

-Ensure spare parts for the Gradall unit are incorporated into the Supply Department Material Support Listings to secure adequate future support.

-Port Services EN, EM, and HT personnel are capable of performing all required maintenance and preventive maintenance (PM). However, a formal PM schedule and training will need to be established and documented.

-All requests for material on-loads and off-loads for the ships will be routed through Port Services first, then to a formally established Port Services Liaison for scheduling. This person will determine if the Gradall will be used or if a crane will be required and schedule either accordingly.

VIII. CONCLUDING REMARKS

The primary objective of this study was to provide the optimal solution to improve efficiency of waterfront operations at Naval Station Long Beach. With budget reductions expected in the future, concern for long-term costs must be considered to ensure the provision of adequate support. Quality and productivity do not have to be traded off against one another. Increases in both aspects of efficiency, quality and productivity, can be achieved through thorough planning.

Before attention was directed toward equipment requirements, the daily operations were reviewed. Overall, waterfront operations perform very well. However, a few communication problems were identified. Establishing a formal liaison billet and a new "Welcome Aboard" Program would improve communications significantly. Communication is a key element to a successful, efficient operation and should be addressed before other aspects of the operation are considered.

The main focus of this study dealt with identifying assets required to establish a Navsta-operated Waterfront Area Shop (WFAS), determining if the solution identified would diminish the problems outlined in the problem statement, and

devising an alternative that would provide the best solution to improve efficiency. It was determined the best way to increase efficiency was not to transfer assets, but to improve control over the one asset causing the friction - crane service. Specifically, the primary functions involving crane service resources that require improvement are brow placement and removal, and short-notice supply onload evolutions. This can be accomplished by purchasing a Gradall Material Handling unit that is capable of performing many of the functions that a crane provides. A Gradall provides Navsta with the desired independence and control while giving them additional flexibility. A highly versatile unit, its numerous applications could be used elsewhere around the Navsta as needed. In so doing, it will enable Navsta to provide improved service to its customers both in availability and timely response. Therefore, the implementation of the Gradall alternative satisfies both needs - improved efficiency and better customer service.

APPENDIX A

SHIP MOVEMENT SCHEDULE

| SHIP | SHIP | | CRANE | | | | COST | * |
|---------------|------|------|-------|----------|-------|----|--------|--------|
| | TYPE | DATE | TIME | MOVEMENT | HOURS | | | |
| DUNCAN | FFG | 10/1 | 1400 | A | 2.0 | \$ | 326.28 | |
| WABASH | AOR | 10/2 | 1230 | C | 3.0 | \$ | 489.42 | |
| TARAWA | LHA | 10/2 | 1900 | D | 0.0 | \$ | 0.00 | *(5) |
| SIDES | FFG | 10/3 | 0800 | D | 1.0 | \$ | 163.14 | |
| PELELIU | LHA | 10/3 | 0800 | D | 0.0 | \$ | 0.00 | *(5) |
| MOBOLE | LKA | 10/3 | 1500 | A | 0.0 | \$ | 0.00 | *(5) |
| SAMUEL COBB | FFG | 10/3 | 1530 | A | 2.0 | \$ | 326.28 | |
| WABASH | AOR | 10/3 | 1000 | C | 3.0 | \$ | 489.42 | |
| ENCOURAGEMENT | MV | 10/3 | 1330 | A | 1.0 | \$ | 163.14 | |
| SIDES | FFG | 10/3 | 1930 | A,B | 0.0 | \$ | 0.00 | *(2) |
| CROMMELIN | FFG | 10/4 | 0800 | A | 2.0 | \$ | 326.28 | |
| PULLER | FFG | 10/4 | 1300 | D | 1.0 | \$ | 163.14 | *(1) |
| TARAWA | LHA | 10/4 | 1800 | A | 0.0 | \$ | 0.00 | *(5) |
| SAMUEL COBB | FFG | 10/4 | 2300 | D | 1.0 | \$ | 163.14 | *(6) |
| F. HAMMON | FF | 10/5 | 1200 | A,B | 0.0 | \$ | 0.00 | *(1,2) |
| P.F. FOSTER | DD | 10/5 | 1330 | A | 2.0 | \$ | 326.28 | |
| FORD | FFG | 10/5 | 1830 | A | 2.0 | \$ | 326.28 | *(6) |
| PRINCETON | CG | 10/6 | 1000 | A | 2.0 | \$ | 326.28 | *(7) |
| MISSOURI | BB | 10/6 | 1700 | A | 2.0 | \$ | 326.28 | *(1,3) |
| P.F. FOSTER | DD | 10/9 | 0800 | D | 1.0 | \$ | 163.14 | |
| DUNCAN | FFG | 10/9 | 0800 | D | 1.0 | \$ | 163.14 | |
| SIDES | FFG | 10/9 | 0900 | D,B | 0.0 | \$ | 0.00 | *(2) |
| ANCHORAGE | LSD | 10/9 | 1000 | D | 0.0 | \$ | 0.00 | *(5) |
| F. HAMMOND | FF | 10/9 | 1030 | D,B | 0.0 | \$ | 0.00 | *(1) |
| BELLEAUWOOD | LHA | 10/9 | 1630 | A | 0.0 | \$ | 0.00 | *(5) |
| CROMMELIN | FFG | 10/9 | 1730 | D | 1.0 | \$ | 163.14 | |
| BOLSTER | FFG | 10/1 | 0750 | D | 1.0 | \$ | 163.14 | |
| VANDERGRIFF | FFG | 10/1 | 0915 | A | 2.0 | \$ | 326.28 | |
| DUNCAN | FFG | 10/1 | 1300 | A | 2.0 | \$ | 326.28 | |
| NAVAL UNIT | --- | 10/1 | 1410 | A | 1.0 | \$ | 163.14 | |
| BOLSTER | FFG | 10/1 | 1530 | A | 2.0 | \$ | 326.28 | |
| NAVAL UNIT | --- | 10/1 | 1600 | D | 1.0 | \$ | 163.14 | *(8) |
| BELLEAUWOOD | LHA | 10/1 | 1630 | D | 0.0 | \$ | 0.00 | *(5) |
| KIRK | FF | 10/1 | 1930 | A,B | 0.0 | \$ | 0.0 | *(2) |
| CALLAGHAN | DDG | 10/1 | 0700 | S | 0.0 | \$ | 0.0 | *(4) |
| CALLAGHAN | DDG | 10/1 | 0715 | D | 1.0 | \$ | 163.14 | |
| PRINCETON | CG | 10/1 | 0715 | D | 1.0 | \$ | 163.14 | *(8) |
| MOBILE | LKA | 10/1 | 0800 | D | 0.0 | \$ | 0.00 | *(5) |
| PELELIU | LHA | 10/1 | 0800 | A | 0.0 | \$ | 0.00 | *(5) |

| | | | | | | | | |
|--------------|-------------|-------------|-------------|-----------------|--------------|----|-------------|----------|
| JARRETT | FFG | 10/15 | 1300 | D | 1.0 | \$ | 163.14 | |
| TARAWA | LHA | 10/16 | 0900 | D | 0.0 | \$ | 0.00 | *(5) |
| | SHIP | | | | CRANE | | | |
| <u>SHIP</u> | <u>TYPE</u> | <u>DATE</u> | <u>TIME</u> | <u>MOVEMENT</u> | <u>HOURS</u> | | <u>COST</u> | <u>*</u> |
| BOLSTER | FFG | 10/16 | 1045 | D | 1.0 | \$ | 163.14 | |
| SAMUEL COBB | FFG | 10/16 | 1500 | A | 2.0 | \$ | 326.28 | |
| DUNCAN | FFG | 10/17 | 1800 | D | 1.0 | \$ | 163.14 | |
| P.F. FOSTER | DD | 10/17 | 1000 | A | 2.0 | \$ | 326.28 | |
| F. HAMMOND | FF | 10/17 | 0805 | A | 2.0 | \$ | 326.28 | |
| SAMUEL COBB | FFG | 10/18 | 0400 | D | 1.0 | \$ | 163.14 | *(6) |
| PULLER | FFG | 10/18 | 0750 | A,B | 0.0 | \$ | 0.00 | *(1,2) |
| CALLAGHAN | DDG | 10/18 | 1400 | A | 2.0 | \$ | 326.28 | |
| DUNCAN | FFG | 10/19 | 0800 | A | 2.0 | \$ | 326.28 | |
| PRINCETON | CG | 10/19 | 0815 | A | 2.0 | \$ | 326.28 | *(8) |
| BOLSTER | FFG | 10/19 | 1200 | A | 2.0 | \$ | 326.20 | |
| PULLER | FFG | 10/20 | 0800 | D,B | 0.0 | \$ | 0.00 | *(1,2) |
| G. PHILLIP | FFG | 10/20 | 0820 | D | 1.0 | \$ | 163.14 | *(1) |
| RACINE | LST | 10/20 | 0840 | D | 0.0 | \$ | 0.00 | *(5) |
| BOLSTER | FFG | 10/20 | 0900 | D | 1.0 | \$ | 163.14 | *(7) |
| DUNCAN | FFG | 10/20 | 0915 | D | 1.0 | \$ | 163.14 | *(7) |
| DUNCAN | FFG | 10/20 | 1530 | A | 2.0 | \$ | 326.28 | *(7) |
| TARAWA | LHA | 10/21 | 0800 | A | 0.0 | \$ | 0.00 | *(5) |
| DUNCAN | FFG | 10/21 | 0900 | D | 1.0 | \$ | 163.14 | *(7) |
| G. PHILLIP | FFG | 10/21 | 1145 | A | 2.0 | \$ | 326.28 | *(7) |
| PULLER | FFG | 10/21 | 1430 | A | 2.0 | \$ | 326.28 | *(7) |
| BOLSTER | FFG | 10/21 | 1450 | A | 2.0 | \$ | 326.28 | *(7) |
| RACINE | LST | 10/21 | 1530 | A | 0.0 | \$ | 0.00 | *(5) |
| DUNCAN | FFG | 10/21 | 1615 | A | 2.0 | \$ | 326.28 | *(7) |
| KIRK | FF | 10/22 | 0745 | S | 0.0 | \$ | 0.00 | *(4) |
| INGRAHAM | FFG | 10/22 | 0800 | D | 1.0 | \$ | 163.14 | |
| GARY | FFG | 10/22 | 0800 | D | 1.0 | \$ | 163.14 | *(8) |
| WABASH | AOR | 10/22 | 1300 | C | 3.0 | \$ | 489.42 | |
| KIRK | FF | 10/22 | ---- | D | 1.0 | \$ | 163.14 | |
| GARY | FFG | 10/22 | 1515 | A,B | 0.0 | \$ | 0.00 | *(2) |
| BOLSTER | FFG | 10/22 | 1500 | D | 1.0 | \$ | 163.14 | |
| DUNCAN | FF | 10/23 | 0600 | D | 1.0 | \$ | 163.14 | |
| GARY | FFG | 10/23 | 0745 | C | 3.0 | \$ | 489.42 | |
| WABASH | AOR | 10/23 | 1100 | C | 3.0 | \$ | 489.42 | |
| KIRK | FF | 10/23 | 1800 | A | 2.0 | \$ | 326.28 | *(6) |
| DUNCAN | FFG | 10/23 | 1730 | A | 2.0 | \$ | 326.28 | *(6) |
| BOLSTER | FFG | 10/23 | 1000 | D | 1.0 | \$ | 163.14 | |
| BOLSTER | FFG | 10/24 | 1330 | A | 2.0 | \$ | 326.28 | |
| WABASH | AOR | 10/24 | 1300 | D | 1.0 | \$ | 163.14 | |
| VANDERGRIFT | FFG | 10/25 | 1200 | C | 3.0 | \$ | 489.42 | *(1) |
| SAMUEL COBB | FFG | 10/25 | 1600 | A | 2.0 | \$ | 326.28 | |
| DUNCAN | FFG | 10/26 | 0700 | S | 0.0 | \$ | 0.00 | *(4) |
| CALLAGHAN | DDG | 10/26 | 0730 | D | 1.0 | \$ | 163.14 | |
| DAVID R. RAY | DD | 10/26 | 1200 | A | 2.0 | \$ | 326.28 | |

| | | | | | | | | |
|-----------|-----|-------|------|-----|-----|----|--------|--------|
| INGRAHAM | FFG | 10/26 | 1600 | A | 2.0 | \$ | 326.28 | |
| MOBILE | LKA | 10/26 | 1900 | A | 0.0 | \$ | 0.00 | *(5) |
| CROMMELIN | FFG | 10/26 | 2100 | A,B | 0.0 | \$ | 0.00 | *(1,2) |
| TARAWA | LHA | 10/26 | 1040 | D | 0.0 | \$ | 0.00 | *(5) |

| <u>SHIP</u> | <u>SHIP TYPE</u> | <u>DATE</u> | <u>TIME</u> | <u>MOVEMENT</u> | <u>CRANE HOURS</u> | <u>COST</u> | <u>*</u> |
|-------------|----------------------|-------------|-------------|-----------------|------------------------|-------------|--------------|
| LOCKWOOD | FF | 10/27 | 1115 | A,B | 0.0 | \$ | 0.00*(1,2) |
| WABASH | AOR | 10/27 | 1215 | A | 2.0 | \$ | 326.28 *(7) |
| MISSOURI | BB | 10/29 | 1600 | C | 3.0 | \$ | 489.42*(1,3) |
| KIRK | FF | 10/29 | 1300 | D | 1.0 | \$ | 163.14 |
| KIRK | FF | 10/29 | 1600 | A | 2.0 | \$ | 326.28 |
| J.A. MOORE | FFG | 10/30 | 0900 | D | 1.0 | \$ | 163.14 |
| DUNCAN | FFG | 10/30 | 0900 | D | 1.0 | \$ | 163.14 *(8) |
| KIRK | FF | 10/30 | 1600 | D | 1.0 | \$ | 163.14 |
| DUNCAN | FFG | 10/30 | 1730 | A | 2.0 | \$ | 326.28 *(6) |
| HEPBURN | FF | 10/31 | 0800 | D | 1.0 | \$ | 163.14 |
| P.F. FOSTER | DD | 10/31 | 0830 | S | 0.0 | \$ | 0.00 *(4) |
| WABASH | AOR | 10/31 | 1700 | D | 1.0 | \$ | 163.14 |

Total..... 119.0

\$19,413.66

Note (1): Types of Movement

- (A): Arrival
- (B): Outboard nested (no crane required)
- (C): Change of pier location
- (D): Departure
- (S): Position shift (no crane required)

Note (2): * Column represents movements which prohibit utilization of the Gradall given the following reasons:

- (1): Pier location (pier 6)
- (2): Ship Located outboard another ship (nested)
- (3): Ship configuration prevents use of Gradall
- (4): Movement is within same pier - crane not needed
- (5): Amphibious ships do not require cranes for brow placement or removal
- (6): After normal working hours
- (7): Weekend or holiday
- (8): Simultaneous movement

Note (3): On 10/25 the USS VANDEGRIFT changed pier locations from Pier 7 to Pier 6. The Gradall can only be utilized for the departure evolution.

APPENDIX B

HOURS OF CRANE SERVICE FOR OCTOBER 1990

| <u>SHIP</u> | <u>TYPE</u> | <u>DATE</u> | <u>PURPOSE</u> | <u>HOURS</u> | <u>COST</u> | <u>*</u> |
|---------------|-------------|-------------|------------------|--------------|-------------|----------|
| DUNCAN | FFG | 10-15-90 | ONLOAD MISSILES | 2.0 | \$326.28 | |
| FORD | FFG | 10-25-90 | STORES | 2.0 | \$326.28 | |
| FORD | FFG | 10-29-90 | HELO DET | 1.0 | \$163.14 | |
| FORD | FFG | 10-29-90 | SODA MACHINE | 1.0 | \$163.14 | |
| FOSTER | DD | 10-19-90 | HELO DET | 1.0 | \$163.14 | |
| FOSTER | DD | 10-22-90 | BOX OFF FLT DECK | 4.0 | \$652.56 | |
| FOSTER | DD | 10-25-90 | 2 SODA MACHINES | 1.0 | \$163.14 | |
| FOSTER | DD | 10-30-90 | OFFLOAD | 1.0 | \$163.14 | |
| FOSTER | DD | 10-23-90 | OFFLOAD MACHINE | 1.0 | \$163.14 | |
| GARY | FFG | 10-12-90 | ORDINANCE | 1.0 | \$163.14 | |
| GARY | FFG | 10-15-90 | DUMMY TORPEDO | 1.0 | \$163.14 | |
| HAMMOND | FF | 10-17-90 | OFFLOAD HELO DET | 1.0 | \$163.14 | |
| JARRETT | FFG | 10-05-90 | HELO MOTOR | 1.0 | \$163.14 | |
| JARRETT/PHIL | FFG | 10-04-90 | ORDINANCE | 1.0 | \$163.14 | |
| JARRETT | FFG | 10-15-90 | OFFLOAD | 1.0 | \$163.14 | |
| KIRK | FF | 10-22-90 | LUBE OIL | 1.0 | \$163.14 | |
| KNOX | FFG | 10-22-90 | MOVE BROW | 1.0 | \$163.14 | *1 |
| L.B. PULLER | FFG | 10-01-90 | HELO DET | 1.0 | \$163.14 | |
| L.B. PULLER | FFG | 10-02-90 | ORDINANCE | 1.0 | \$163.14 | |
| LOCKWOOD | FF | 10-27-90 | OFFLOAD HELO DET | 1.0 | \$163.14 | *3 |
| MISSOURI | BB | 10-11-90 | STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-12-90 | STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-15-90 | STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-17-90 | STORES | 2.0 | \$326.28 | *2 |
| MISSOURI | BB | 10-17-90 | STORES | 3.0 | \$489.42 | *2 |
| MISSOURI | BB | 10-19-90 | FROZEN STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-22-90 | STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-25-90 | STORES | 4.0 | \$652.56 | *2 |
| MISSOURI | BB | 10-29-90 | 5 EA 55 GL OIL | 1.0 | \$163.14 | *2 |
| PELELIU | LHA | 10-02-90 | STD BY LCU | 1.5 | \$244.71 | *2 |
| PELELIU | LHA | 10-16-90 | FROZEN STORES | 2.0 | \$326.28 | *2 |
| PELELIU | LHA | 10-18-90 | STORES | 2.0 | \$326.28 | *2 |
| PELELIU | LHA | 10-25-90 | STORES | 4.0 | \$652.56 | *2 |
| PELELIU | LHA | 10-29-90 | ONLOAD 2 PALLETS | 1.0 | \$163.14 | *2 |
| PELELIU | LHA | 10-30-90 | ONLOAD STORES | 4.0 | \$652.56 | *2 |
| PORT SERVICES | | 10-05-90 | DUMPSTERS | 1.0 | \$163.14 | |
| PORT SERVICES | | 10-05-90 | HP BOAT | 1.0 | \$163.14 | ** |
| PORT SERVICES | | 10-19-90 | DUMPSTERS | 1.0 | \$163.14 | |
| PORT SERVICES | | 10-23-90 | DUMPSTER ORD. | 1.0 | \$163.14 | *1 |
| PORT SERVICES | | 10-29-90 | DUMPSTERS | 1.0 | \$163.14 | |

| | | | | | | |
|---------------|-------------|-------------|-------------------|--------------|-----------------|----------|
| PORT SERVICES | | 10-31-90 | DUMPSTERS | 1.0 | \$163.14 | |
| PRINCETON | CG | 10-06-90 | STORES/SHORE PWR | 3.0 | \$489.42 | *3 |
| <u>SHIP</u> | <u>TYPE</u> | <u>DATE</u> | <u>PURPOSE</u> | <u>HOURS</u> | <u>COST</u> | <u>*</u> |
| PRINCETON | CG | 10-09-90 | HELO DET | 1.0 | \$163.14 | |
| PRINCETON | CG | 10-19-90 | HELO DET OFFLOAD | 1.0 | \$163.14 | |
| PULLER | FFG | 10-18-90 | HELO DET OFFLOAD | 1.0 | \$163.14 | *1 |
| RACINE | LST | 10-16-90 | OFFLOAD COPY MAC. | 1.0 | \$163.14 | |
| RAY | DD | 10-29-90 | HELO DET | 2.0 | \$326.28 | |
| SIDES | FFG | 10-01-90 | ORDINANCE | 1.0 | \$163.14 | |
| SIDES | FFG | 10-01-90 | OFFLOAD MISSILE | 1.0 | \$163.14 | |
| VANDERGRIFF | FFG | 10-16-90 | OFFLOAD HELO DET | 1.0 | \$163.14 | |
| WABASH | AOR | 10-10-90 | HELO DET | 2.0 | \$326.28 | *2 |
| WABASH | AOR | 10-22-90 | OFFLOAD LIFT | 1.0 | <u>\$163.14</u> | *2 |
| | | | | | \$14,764.17 | |

NOTE : * A single asterisk indicates evolutions that preclude the use of the Gradall and would still require crane service. The number indicates the reason:

- (1): Pier location (pier 6)
- (2): Ship configuration prevents use of a Gradall
- (3): Weekend or holiday (assumes Gradall is only operated Monday-Friday)

** A double asterisk denotes evolutions that due to unavailability of total weight of the load involved, it can not be determined if a Gradall could have been used.

APPENDIX C

LIST OF ASSET REQUIREMENTS FOR A WFAS

This list was compiled by LT Cassano during the beginning of his tour as the Navsta Port Services Officer. It is based on input from various Shipyard and Port Service Department personnel. Information regarding quantities and physical status of items were obtained through inventory documents maintained at Building 300 and by oral communication with shop supervisors.

| <u>EQUIPMENT TYPE</u> | <u>ASSETS REQD</u> | <u>NAVSTA OWNED</u> | <u>SHORT FALL</u> | <u>SHPYD OWNED</u> | <u>*REMARKS</u> |
|---|------------------------|-------------------------|-----------------------|------------------------|-----------------------------------|
| TUG (YTB) | 3 | 3* | 0 | 0 | INCLUDES YTB 822 |
| YARD OILER (YO) | 3 | 3 | 0 | 0 | |
| YARD OILER (YOM) | 1 | 1 | 0 | 1* | YOM-2 |
| YARD CRAFT (YC) | 4 | 1 | 3 | 10 | |
| PUSHER BOAT (LCM) | 6 | 6* | 0 | 4 | 2 REQUIRE SURVEY |
| TRUCK, STAKE BED | 4 | 1 | 3 | 36 | |
| TRUCK, PICKUP | 6 | 4 | 2 | 50+ | |
| PAINT FLOAT, SCAFFOLD | 5 | 1* | 4 | 2 | HAVE 5 BUT 4 ARE UNSERVICEABLE |
| DONUTS, OILY WASTE | 24 | 6 | 18 | 27* | 15 NOT IN SERVICE |
| TANK, APFF COLLECTION (2500 GAL, PORTABLE) | 10 | 0 | 10 | 10 | |
| TANK, SODIUM NITRATE (2500 GAL, PORTABLE) | 10 | 0 | 10 | 10* | 3 NOT IN SERVICE |
| TANK, OILY WASTE COLL | 5 | 0 | 5 | 7 | |
| BARGE, SODIUM NITRATE | 1 | 0 | 1 | 3 | |
| BARGE, OILY WASTE COLL | 1 | 0 | 1 | 2 | |
| BARGE, CHT/SEWAGE (SWOB) | 2 | 0 | 2 | 2 | |
| BROW, 60' STRAIGHT STEEL | 2 | 0 | 2 | 9 | |
| BROW, 50' STRAIGHT STEEL | 8 | 0 | 8 | 11 | |
| BROW, 45' STRAIGHT STEEL | 2 | 0 | 2 | 7 | |
| BROW, 40' STRAIGHT STEEL | 2 | 0 | 2 | 8 | |
| BROW, 35' STRAIGHT STEEL | 2 | 0 | 2 | 6 | |
| BROW, 50' SHIP-TO-SHORE | 8 | 0 | 8 | 11 | |
| BROW, PLATFORM | 4 | 0 | 4 | 4 | |
| BROW, 30' HUMPBACK STEEL | 9 | 0 | 9 | 9 | |
| BROW, 26' HUMPBACK STEEL | 6 | 0 | 6 | 6 | |
| BROW, 22' FFG FIBERGLASS | 8 | 0 | 8 | 2* | 30' STRAIGHT FIBERGLASS |
| BROW, 24' HUMPBACK STEEL | 3 | 0 | 3 | 6 | |
| PLATFORM, BROW 2-TIER 15' | 2 | 0 | 2 | 2* | SHOP 64 BEST ESTIMATE |

| <u>EQUIPMENT TYPE</u> | <u>ASSETS REQD</u> | <u>NAVSTA OWNED</u> | <u>SHORT FALL</u> | <u>SHFYD OWNED</u> | <u>*REMARKS</u> |
|---|------------------------|-------------------------|-----------------------|------------------------|--|
| PLATFORM, BROW 2-TIER 12' 4 | | 0 | 4 | 4* | SHOP 64 BEST ESTIMATE |
| PLATFORM, SINGLE TIER 3' 4 | | 0 | 4 | 4* | SHOP 64 BEST ESTIMATE |
| PLATFORM, ADJUSTABLE SINGLE 4* | | 0 | 4 | 4 | USED ON PIER 7 FOR CG 47 |
| PLATFORM, CHG-OF-CMD 12X12 2 | | 0 | 2 | 3 | |
| PLATFORM, CHG-OF-CMD 10X10 2 | | 0 | 2 | 1 | |
| PLATFORM, EXT (BB KNEEOUT) 2* | | 0 | 2 | 2 | ADAPTED FOR BB BROW PLACEMENT WHEN REQUIRED |
| PLATFORM, EXT (KNEEOUT) 2 | | 0 | 2 | 6 | |
| FENDER, MARINE, FOAM AND HARD RUBBER COMPOSITE | 49 | 49 | 0 | N/AVAIL | |
| CAMEL, AIRCRAFT SPREADER 37' X 70' | 6 | 3 | 3 | 3 | ADDITION OF WOOD PLAT- FORM WOULD MAX. USE AS A STAGING BARGE |
| CAMEL, BULK 20' X 40' 6 | 6 | 6 | 0 | 0 | |
| CAMEL, BULK 15' X 20' 6 | 3 | 3 | 3 | 0 | |
| CAMEL, SPREADER 10' X 20' 18 | 9 | 9 | 9 | 30 | |
| FORKLIFT, 6000lb CAPACITY 1* | 1 | 1 | 0 | 8 | PROVIDED BY LT McKEOUGH |
| FORKLIFT, 20,000lb CAPACITY 1* | 0 | 0 | 1 | 1 | PROVIDED BY LT McKEOUGH |
| CRANE, PORTAL 3 | 0 | 0 | 3 | 17 | 1 EACH FOR PIERS ECHO- SOUTH, WEST, AND PIER 6 |
| CRANE, TRUCK, 100' BOOM 1 | 0 | 0 | 1 | 1 | BOOM LNTH QUESTIONABLE |
| CRANE, TRUCK, 60'-80' BOOM 3 | 0 | 0 | 3 | 5 | QUANTITY QUESTIONABLE, 1 P&H/ TC-7 50,000lb CRANE CAN SUFFICE FOR THIS ITEM AND ONE PRECEDING |
| CRANE, FLOATING (100' BOOM) 1 | 0 | 0 | 1 | 2 | |
| HOSE, FIREMAIN, 2 1/2" X 50' 80 | 0 | 0 | 80 | 582 | |
| HOSE, CHT/SEWAGE, 4" X 50' 100 | 0 | 0 | 100 | 125 | |
| HOSE, STEAM, 1 1/2" X 25' 175 | 0 | 0 | 175 | 501 | |
| HOSE, POTABLE WATER, 1 1/2" X 50' 60 | 0 | 0 | 60 | 95 | |
| HOSE, POTABLE WATER, 2 1/1" X 50' 100 | 0 | 0 | 100 | 182 | |
| HOSE, L.P. AIR, 1 1/2" X 50' 75 | 0 | 0 | 75 | 778 | |
| MANIFOLDS, L.P. AIR 50 | 0 | 0 | 50 | 265 | |
| CABLE, TELEPHONE 100' 25 | 0 | 0 | 25 | UNKNOWN | SHIPS NORMALLY PROVIDE PHONE LINE TO PIER JUNCTION BOX |
| CABLE, ELEC, T400, 100' 8 | 0 | 0 | 8 | 25 | SINGLE CONDUCTOR CABLE FOR ARS-38 CLASS |
| CABLE, ELEC, T500, 100' 30 | 0 | 0 | 30 | 30 | |
| CABLE, ELEC, T500, 150' 145 | 0 | 0 | 145 | 145 | |

| <u>EQUIPMENT TYPE</u> | <u>ASSETS REQD</u> | <u>NAVSTA OWNED</u> | <u>SHORT FALL</u> | <u>SHPYD OWNED</u> | <u>*REMARKS</u> |
|--|------------------------|-------------------------|-----------------------|------------------------|---------------------|
| CAMEL, SUBMARINE SPREADER 2 (UNCUSHIONED) | 2 | 2* | 0 | 0 | LOAN FROM SAN DIEGO |
| CAMEL, SUBMARINE SPREADER 2 (CUSHIONED) | 2 | 2* | 0 | 0 | LOAN FROM SAN DIEGO |
| SLING, CRANE (BROW PLACEMENT) | 8 | 0 | 8 | 20+ | |
| SLING, CRANE, NYLON (PR) | 2 | 0 | 2 | 2 | |
| SLING, CRANE, LIFERAFT OFFLOAD/ONLOAD | 1 | 0 | 1 | 1 | |
| SLING, CRANE, PALLET BAR | 3 | 0 | 3 | 2 | |
| SLING, CRANE, AMMUNITION | 3 | 0 | 3 | 2 | |
| RAMP, VEHICLE/AUTO | 1 | 0 | 1 | 1 | |
| RAMP, MARINE VEHICLE | 2 | 0 | 2 | 2 | |
| FORKLIFT, TELESCOPIC BOOM | 1 | 0 | 1 | 1+ | |

APPENDIX D

GRADALL MATERIAL HANDLER
LIST OF STANDARD FEATURES

1. Self leveling hydraulics for forks.
2. Safety checks on hoist, crowd, tilt.
3. Full powershift transmission, 3 speeds forward and reverse.
4. 7'7" overall height.
5. Four wheel drive.
6. Sway control on front axle.
7. Planetary drive axle.
8. Rear 90 degree pivot steering.
9. Power steering - full hydraulic.
10. Hydraulic power assist enclosed wet disc service brakes.
11. Spring applied hydraulic release park brake.
12. 13:00 x 24 (12) ply tires.
13. Seat belt.
14. 40 gallon fuel tank.
15. Exhaust muffler.
16. Dry type air cleaner.
17. 61 Amp. alternator.
18. Battery - 565 CCA (Two with diesel).
19. Single hydraulic pump.
20. Manual quick switch.
21. Operator protective canopy.
22. Adjustable upholstered seat.
23. Horn - back up alarm.
24. Ammeter, fuel gauge, water temperature, oil pressure gauges, converter temperature gauge.
25. Machine leveling indicator.

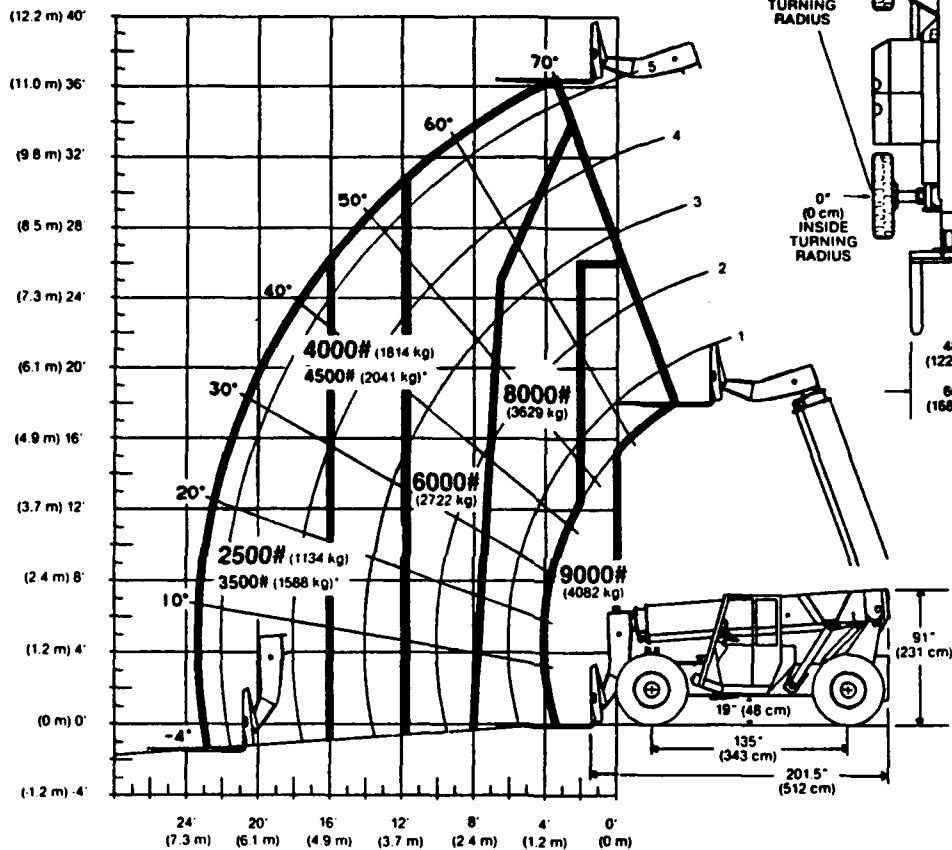
| | | |
|------------------------------|---------------------|------------------|
| | <u>Model 534B-9</u> | <u>Model 544</u> |
| Subtotal price: | \$72,000 | \$91,250 |
| Accessories and Attachments: | | |
| Auxiliary Hydraulic Valve: | \$1,800 | included |
| Swing Carriage: | \$4,200 | \$4,200 |
| Outriggers: | \$4,700 | included |
| Instant hook: | <u>\$2,700</u> | <u>\$3,200</u> |
| TOTAL PRICE: | \$80,700 | \$98,650 |

Note: Prices subject to manufacturer's price at time of sale. Delivery charges are not included (F.O.B. Monterey). Prices and information received from Western Traction Company, 1333 Atlantic Street, Union City, CA (415-487-3100).

534B-9

**3 SECTION BOOM
FOUR-WHEEL DRIVE
ROUGH TERRAIN**

**PIVOT STEER
9,000 LBS. (4,082 kg) MAX. CAP.**



*With Optional Outriggers Down.

PERFORMANCE SPECIFICATIONS

RATED CAPACITY at 24" (61 cm)
Load Center . . . 9,000 lb. (4,082 kg)

LIFT SPEED (Boom Retracted)
Empty 105 f.p.m. (32 m/min)
Loaded 80 f.p.m. (24 m/min)

BOOM SPEED
Extend 100 f.p.m. (30 m/min)
Retract 160 f.p.m. (49 m/min)

GRADEABILITY
Empty 85%
Loaded 80%
Limited by traction conditions

TRAVEL SPEEDS — Forward & Reverse
Gear Speed MPH (Km/Hr)
1 3.1 (5.0)
2 6.6 (10.6)
3 15.9 (25.6)
Road 17.9 (28.8)

DRAWBAR PULL
Empty 11,000 lb. (4,990 kg)
Loaded 17,000 lb. (7,711 kg)

OPERATING WEIGHT
W/Carriage
& Forks 22,260 lb. (10,097 kg)

IMPORTANT

Rated lift capacities shown are with machine on a firm, level surface with undamaged, properly inflated CaCl filled tires. Machine specifications and stability are based on rated lift capacities at specific boom angles and boom lengths. If specifications are critical, the proposed application should be discussed with your dealer.

DO NOT exceed rated lift capacity loads, as unstable and dangerous machine conditions will result. DO NOT tip the machine forward to determine the allowable load. Handling personnel with the boom is not authorized.

A Four-Wheel Drive, Rough Terrain Machine with 90° Pivot Steering.

The Gradall 534B-9 Material Handler is designed for use on the most demanding applications. Particularly popular on the construction site, the 534B-9 has a maximum capacity of 9,000 lb. (4082 kg) and a lifting height of 38' (10.97 m). The second boom section is extended and retracted by a single cylinder and the third section by heavy cable anchored to the outer boom.



On uneven terrain, sway control lets the operator tilt the entire frame assembly up to 8° in either direction to keep the load level. In addition, automatic fork leveling keeps the forks at a constant angle with the ground. Leveling cylinders pinned to the back of the boom and frame allow oil to flow to and from tilt cylinder as boom is raised and lowered.

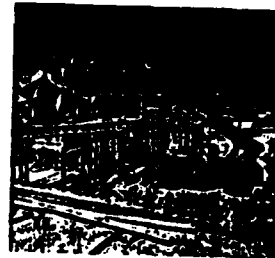
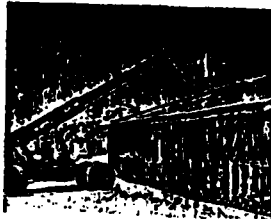


A combination of mechanical and hydrostatic drive, short length, and 90° pivot steering make the 534B-9 highly maneuverable in tight quarters. Outside turning radius is less than the length of the chassis.

And the 534B-9's low height and long wheelbase give you increased stability.



The unique combination of tight-quarter maneuverability, boom speed, good visibility, and a power-shift transmission give you a quick, agile, easy-to-operate Material Handler.



Exceptional versatility is standard equipment on the Model 534B-9, keeping the handler in productive operation. With the QUICK-SWITCH™ coupler, the operator can change to a variety of attachments without assistance. Available attachments include: carriage, forks, buckets, truss boom, truss boom with instant hook, 8' mast and swing forks.



Operator comfort and convenience were important in the design of the Gradall Handler. Controls are grouped for convenience during operation. Single-lever control of lift and crowd facilitates horizontal fork travel.

The 534B-9 is built for reliability and easy maintenance. Consider the one-piece weldment main frame, planetary drive axle, planetary rear hubs, and heavy-duty boom sections — design features that keep your Handler out of the shop and on the job. Reliability, easy maintenance, and optimum versatility of the 534B-9 make the best use of your time and resources.

Some illustrations may show options.

Gradall is a registered trademark for hydraulic excavators, hydraulic material handlers, and attachments built by The Gradall Company.

LIST OF REFERENCES

1. Robinson, Scott A., "Port Services Study," Report to the Commanding Officer, Naval Station Long Beach, p. 6, October 1988.
2. Interview between J. Snyder, LCDR, CEC, USN, Facilities Officer, Naval Station Long Beach, and S. Hammon, LT, SC, USN, 24 October 1990.
3. Interview between C. Cassano, LT, USN, Port Services Officer, Naval Station Long Beach, and S. Hammon, LT, SC, USN, 12 October 1990.
4. Telephone conversation between Bob Patterson, Code 214 Long Beach Naval Shipyard, and S. Hammon, LT, SC, USN, 25 October 1990.
5. Christiansen, E., LT, USN, Port Services Operations Officer, Naval Station Long Beach, Memorandum to S. Hammon, LT, SC, USN, 19 November 1990.
6. Interview between E. Christiansen, LT, USN, Port Services Operations Officer, J. Doughty, FCC, USN, Naval Station Long Beach, and S. Hammon, LT, SC, USN, 25 October 1990.
7. Interview between E. Christiansen, LT, USN, Port Services Operations Officer, Naval Station Long Beach, and S. Hammon, LT, SC, USN, 24 October 1990.
8. McKeough, L.R., LT, USN, Port Services Operations Officer, Naval Station Long Beach, Memorandum to S. Hammon, LT, SC, USN, 13 November 1990.
9. McKeough, L.R., LT, USN, Port Services Operations Officer, Naval Station Long Beach, Memorandum to S. Hammon, LT, SC, USN, 25 January 1990.
10. Interview between M. Kovac, Western Traction Company, Vice President - Marketing, Monterey, California, and S. Hammon, LT, SC, USN, 1 February 1991.

11. Anthony, Robert N., and Young, David W., Management Control in Nonprofit Organizations, p. 409, Richard D. Irwin Inc., 1988.

12. Telephone conversation between Mr. Krugher, Code 02, Long Beach Naval Shipyard, and S. Hammon, LT, SC, USN, 25 March 1991.

BIBLIOGRAPHY

Blanchard, Benjamin S., *Logistics Engineering and Management*, 3rd ed., Prentice-Hall, Inc., 1986.

Muchinsky, Paul M., *Psychology Applied to Work - An Introduction to Industrial and Organizational Psychology*, 3rd ed., Wadsworth, Inc., 1990.

Stevenson, William J., *Production/Operations Management*, 3rd ed., Richard D. Irwin, Inc., 1990.

Stewart, Rodney D. and Wyskida, Richard M., *Cost Estimator's Reference Guide*, John Wiley & Sons, Inc., 1987.

INITIAL DISTRIBUTION LIST

- | | | |
|----|--|---|
| 1. | Defense Technical Information Center Cameron Station Alexandria, Virginia 22304-6145 | 2 |
| 2. | Superintendent Attn: Library, Code 52 Naval Postgraduate School Monterey, California 93943-5000 | 2 |
| 3. | Commanding Officer Naval Station Long Beach, California 90822-5000 | 2 |
| 4. | Lieutenant Shelly M. Hammon 8314 Frosty Court Lorton, Virginia 22079 | 1 |
| 5. | Professor Dan C. Boger Code AS/BO Naval Postgraduate School Monterey, California 93943-5000 | 1 |